GENERAL SUPPORT OF BIOMEDICAL RESEARCH

Analytical Issue Paper

Long-Range Plan, 1972-1976

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Division of Research Resources
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CONTENTS

HIGHLIGHTS

The Issue

The Assistant Secretary for Health and Scientific Affairs, DHEW, and the Bureau of the Budget (now Office of Management and Budget) requested that the NIH Long-Range Plan, 1972-1976, include an analysis of general support of biomedical research which would discuss certain topics and answer certain questions. Those topics and questions are:

What have been the objectives of the program and to what extent have the objectives been approximated through previous allocations?

What is the anticipated impact of reductions in general research support?

Are the objectives still worth pursuing, and, if so, what alternatives to the GRS program might be used--at what cost?

The advantages and disadvantages of distributing research funds under GRS when high quality project grants go unfunded.

The impact of distributing GRS funds on a formula basis: does it go to a limited number of first-rate research institutions rather than to help new or weak research institutions.

A comparative assessment of the quality of research under GRS compared to that under the project grant mechanism.

The Objectives of General Research Support and How They Have Been Met

Authority for general support of biomedical research was established in recognition of the need for giving institutions greater control over the quality, content, emphasis and direction of their research activities than was possible under the research project grant system alone. The GRS programs provide funds on a continuing basis to eligible institutions for flexible and judicious use in their health research and research training activities. The fundamental rationale of the GRS programs is that effective health research requires a strong institutional base as well as direct project support. General research support enables each institution to develop in ways generally not associated with project support or other research and training support programs. It is the principal element in the total support system through which an institution can forge new directions, innovate programs and support fledgling ideas and the people willing to tackle them.

A recent study of the GRSG program (Roth-Boynton, page 21*) concluded that the objectives of the program are being met, and in a fashion which would not have been possible with funds supplied through the research project and research training mechanisms. The study clearly indicated that GRSG funds make a significant contribution that is distinctive when compared

*Page numbers refer to this paper.

with other sources of research funds. The uniqueness of the GRSG program was found to be in neither the specific research projects supported nor in the magnitude of the program, but in the flexibility provided to the institutions to interpret their own most pressing needs at any given time and to act.

The Roth-Boynton study found that the most important contributions of the GRSG program are: (1) exploitation of emerging opportunities in research, especially through the initial support of new ideas; (2) stabilization of grantee institutions' own biomedical sciences structure; and (3) early recognition of talent through local selection of research personnel and of students to be supported. Virtues of the GRSG program that either enhance or make possible its contributions were identified by the study as: (1) facilitates institutional growth and development; (2) allows flexibility in the use of grant funds; (3) facilitates innovation; (4) grant funds can be allocated without long delays; (5) allows planning and implementation of long-range goals; (6) allows balancing of institutional research programs; and (7) provides for the local control of grant funds (pages 29-34).

A major contribution of the GRSG program is new central or shared resources, departments, and other research components which it assists in creating to build areas of research strength. GRSG funds were used in 481 of the 686 new departments or research units established by 184 GRSG awardees during 1962-1967, and was the primary source of initial funding for a third of these units. At the same time, 193 grantees strengthened

848 existing departments and research units, using GRSG funds in 703 cases (pages 50-56).

The study found that the percentage of all research projects that received major or sole support from GRSG funds ranged from 9.6 percent at medical schools to 41.7 percent at dental schools. Pilot research projects, as a percentage of all research projects, ranged from 9.0 percent at medical schools to 28.1 percent at dental schools. GRSG funds were the sole or major support for 1,994, of 3,401 pilot projects, and provided 78 percent of their support (pages 34-39).

GRSG funds were found to be used frequently as interim support for research projects that subsequently are awarded support from other sources. During the first five years of the GRSG program, GRSG support resulted in the attraction of $57,546,000 in additional nonfederal support at 189 institutions and $90,928,000 in additional Federal research support at 135 institutions (page 39).

GRSG trainee support has been used mainly in medical and dental schools, primarily as a means of introducing medical and dental students into research. During 1966-67, 94 percent of these schools used GRSG funds for training. Although less than 6 percent of GRSG funds are expended on trainees, such funds provided in 1966-67, summer appointments for 1,880 medical and dental students and short-term training at other times during the year for 878 medical and dental students (page 46).

More than 70 percent of the 90 medical schools surveyed used funds to stabilize research activities through salary support; 26 percent of the 39 schools of osteopathy, pharmacy, public health and veterinary medicine used GRSG funds in this way; and approximately 50 percent of 165 dental schools, hospitals, health departments, and research institutions said that GRSG support helped to stabilize their development in this fashion. Salary support was by far the largest contribution made by the GRSG program in stabilizing research programs (page 46).

Thus the general support of biomedical research is being achieved successfully through the GRS programs authorized by a revision of the Public Health Service Act signed by President Eisenhower in 1960. GRS programs implement a policy of returning to local institutions the responsibility for decision making in the allocation of a portion of their research and research training funds. This policy represents a concept which a decade later has been shown to be effective and which characterizes one aspect of the New Federalism enunciated by President Nixon.

Impact on Institutions of Distribution of Funds by the GRSG Formula

The impact of the distribution of GRSG funds by formula has been examined in terms such as public or private grantees, class of grantee institutions (e.g., medical schools, dental schools, hospitals, etc.), and size of awards in relation to amounts of NIH-NIMH research grants. Health professional schools receive two-thirds of the funds in the GRSG program. Medical schools constitute 29.1 percent of GRSG grantees, but

they receive 53.0 percent of GRSG funds (pages 68 -78). New and developing medical schools compete effectively for GRSG funds presumably because those schools have recognized the importance of research to their goal of preparing well-trained physicians and therefore have recruited outstanding teacher-investigators who are successful in securing NIH-NIMH research project support.

There is no simple answer to the question, "Does it (general research support) tend to go to a limited number of first-rate institutions rather than to help develop new or weak institutions?" Both types of institutions receive general research support. In absolute terms the bulk of the monies goes to those institutions which have the greatest commitment to biomedical research, but in relative terms, the yield in dollars of GRS per dollar of NIH and NIMH research projects is much higher to the smaller, weaker, and younger institutions.

Comparison of Quality of Research Under GRS With That Under the Project Grant Mechanism

Research project grant funds are used to support specific research projects. GRS funds are used for purposes in addition to the support of research projects, such as central or shared resources, faculty recruitment, exploratory research, support of new and young investigators, and strengthening of the institutional capability in research. Such uses are an indirect form of support of specific research projects and are aimed at facilitating their conduct and enhancing their productivity. Even when GRS funds are used for research projects, they are used frequently in a manner for which research project grants are unsuitable or unavailable, for

example, interim support until a research project grant can be awarded, and support of pilot research, which is characteristically a high risk type of research. These differences in the purposes and uses of research project grants and general research support place a major limit on the validity of a direct comparison of the quality of activities supported by the two grant mechanisms. However, both GRS and project grant-supported research activities are characterized by "quality." Under each mechanism research is supported on the basis of the promise of meaningful results. Quality judgments for the GRS programs are the responsibility of committees established by the grantee institutions to plan and to review the allocation of GRS funds. National committees review and advise on applications for Federal support of biomedical research projects. The qualities of the activities supported by the two mechanisms converge when GRS funds are employed to establish or to strengthen institutional resources used in the conduct of project grant-supported research. In summary, there are many quality control mechanisms operative both at the local and national levels which assure that "quality" is a prime consideration in the allocation of funds under the GRS programs (pages 80-81).

Advantages of Awarding General Research Support When High-Quality Research Grants Go Unfunded (pages 98-108)

The Roth-Boynton study identified the unique advantages of the GRSG program. It demonstrated that because of the special terms and conditions under which the awards are granted, these awards have special institutional values for the institutions that are not served by funds from research project grants. For example, institutional autonomy and decision-making

authority in the use of GRSG funds may well be as important as the grant money itself because the flexibility afforded by GRSG policies provides a financial basis necessary for innovation and development. It must be recognized that the objectives of the GRS programs are continuing ones and, therefore, provisions for meeting them must continue. Although the financial climate in which biomedical research is conducted in the 70's is markedly different from that which prevailed when the GRSG program was launched in 1962, needs for this type of flexible support, which allows for local decision making, remain at least as acute now as they were earlier for the institutional population served. Moreover, the vigor and effectiveness of biomedical research at an institution, even with a steady level of effort, depend upon the creation of some new programs, departments, and resources to readjust priorities, to maintain quality, and to insure maximal productivity.

A stringent NIH budget for research project grants has elevated the general quality of NIH project grant supported research because of the competition for available support funds on the basis of scientific merit. In the process, some institutions have fared better than others in commanding NIH research support. Resultant changes in the distribution of research project funds among institutions is reflected in parallel changes in the distribution of general research support. Consequently, the quality of GRS activities is enhanced to the extent that general research support is used to reinforce project grant supported research by providing central institutional research resources and by strengthening

institutional research capability. The recent reductions in GRS funds also might have elevated the general quality of GRS activities by a selection process like that described above. However, when GRS activities can not be differentiated on the basis of quality alone, when the level of quality is so high that differences in quality are no longer meaningful, and when differences in quality are so small that they are not significant, continued reductions in general research support have the primary effect of curtailing the achievement of GRS goals, the importance of which is documented in this issue paper.

The Federal Government depends heavily on non-Government research and educational institutions to pursue its goals of improving both maintenance and restoration of health by creating new knowledge and by providing the physicians and other health personnel necessary to achieve these goals. As long as these Federal demands continue on a large scale, and private, and state and local government funds are not available to meet the general research needs of these institutions, the Federal Government will need to provide general research support.

Substitution of increased research project grant funds for general research support would make it possible to fund additional approved project grant applications for the benefit of some individual principal investigators, but at the expense of investigators with research project grant support and their institutions who otherwise benefit from the important and unique features of general research support that help to

hold together and strengthen the research enterprise of the institution. Therefore, such substitution of one type of research support for another would be undesirable.

Alternatives to Current GRS Programs

Alternatives to the present separate GRS mechanisms have been considered. These are: (1) consolidation of general research support with health professions educational assistance programs; (2) termination of NIH general research support and meeting the need with NSF programs under existing authority or under new authority such as that proposed in the 1969 Miller Bill (H.R. 35); and (3) award of project grants with a portion of each designated for general research support in lieu of a separate GRS mechanism.

Consolidation of General Research Support with Health Professions Educational Assistance Programs

This alternative appears, at first sight, to be feasible because formula grants are common to both programs and because health professional schools are eligible for grants from both programs. Advantages of consolidation would be that the number of grant programs would be reduced and that grantees eligible for both types of support could be given authority to expend funds from a common or combined award for research and for educational purposes in any proportion determined by the grantee. However, general research support and health professions

educational assistance have only superficial similarities. They serve different needs and purposes. The needs for each type of support vary in magnitude and in proportion to each other from one institution to another. Health professions educational assistance is limited to undergraduate education in the health professions, but general research support is employed not only at undergraduate levels in health professional schools, but also at graduate and postgraduate levels, and in institutions such as hospitals, academic institutions other than health professional schools, and non-academic research institutions. Since research and education appropriations are made separately, it would be difficult to assure that funds would be used for the purpose appropriated if the programs were consolidated. Because of significant differences in the purposes, characteristics, and clientele of the two types of support, their consolidation would result in distortion of their purposes and dilution of their effectiveness (pages 109-116).

Termination of NIH General Research Support and Meeting the Need With NSF Programs

Transfer of general support of biomedical research from NIH to NSF would focus institutional support of science in one agency, and could result in a reduction in the number of programs if institutional formula grants for research from both agencies were consolidated. Notable

differences exist between general research support and NSF institutional formula grants. There is a lack of congruence in grantee institutions served. NSF awards are made only to academic institutions which include many that are not engaged in biomedical research and others that presently are not eligible for NIH general research support. NIH awards for general support of biomedical research in FY 1969 totaled four times the dollars awarded in NSF institutional formula grants, and the number of NIH awards was approximately two-thirds the number of NSF awards. These differences would make it difficult to consolidate the programs without diluting their effectiveness particularly for NIH grantee institutions. If NIH general research support programs were transferred to NSF, whether or not they were consolidated with NSF programs, the coordination of general research support with NIH research project support would become overly complicated and lose effectiveness. NIH would no longer have the capability of pursuing its biomedical research mission through institutional support, and there would be loss of assurance that university officials would allocate to biomedical research the amount of general research support needed for that purpose. Additionally, NIH staff possesses a depth and scope of expertise in biomedical research and related health professional education unmatched by other Federal agencies. It is concluded that transfer of biomedical general research support programs to NSF would not be in the national interest (pages 116-120).

Award of NIH Research Project Grants With A Portion of Each Designated For General Research Support In Lieu of A Separate GRS Mechanism

This alternative would reduce the number of grant programs.

However, it carries the risk that grantor institutes would urge or constrain grantee institutions to expend such funds for research relevant to the mission of the grantor institute, with consequent loss of the important flexibility feature of general research support. Fiscal, programmatic, and evaluative responsibilities would be fragmented with attendant duplication and loss of coordination. If the decremental scale of general research support in relation to institutional levels of NIH-NIMH research project grant support were to be continued, and there are good reasons that it should be continued, it would be necessary to establish a complex system to coordinate project grant support at each institution with the amount designated for general research support. In summary, the inclusion of general research support in each research project grant does not compare favorably with the present unified and coordinated general research support program (pages 120-122).

Summary of Alternatives

Each of the alternatives described above would achieve the desirable result of reducing the number of programs, but not necessarily simplification of programs. In fact, administration of the programs would become more complicated for both the Federal Government and the grantee institutions, as long as existing program objectives were continued. Changes in both legislative authority and appropriations structure would be required to effect merger of GRS programs with either Health Professions Education Assistance or National Science Foundation institutional formula grant programs. Since general research support plays a significant role in the pursuit of

health objectives, as documented throughout this paper, and since none of the alternatives would achieve the objectives of general research support as effectively as do the present GRS programs, the alternatives described are rejected.

Conclusion

The merits of general support of biomedical research and the success of GRS programs have been demonstrated. Alternatives to separate GRS programs would result in either abandonment of the benefits achieved from general research support or dilution of its effectiveness. Continuing evaluation of GRS programs will make it possible to identify ways in which they might be improved or strengthened, and to modify them in response to changing needs when they occur.

GENERAL SUPPORT OF BIOMEDICAL RESEARCH

INTRODUCTION

The Assistant Secretary for Health and Scientific Affairs, DHEW, in a memorandum dated March 27, 1970, entitled Guidelines for Preparation of Materials for the Long Range Plan, FY 1972-1976, under Major Issues for Analysis, asked the following questions about general support of biomedical research:

> "What have been the objectives of the program, and to what extent have the objectives been approximated through previous allocations?
>
> "What is the anticipated impact of reductions in general research support?
>
> "Are the objectives still worth pursuing, and, if so, what alternatives to the GRS program might be used--at what cost?"

The Bureau of the Budget specifications for this analysis are stated as follows:

> "Issue: In the period when the policy of the Federal Government was to build up as rapidly as possible the capability for research in the life sciences of broad scope and when the availability of funds generally posed no limitation, the general support of biomedical research could be justified as:
>
> * providing an institution an opportunity to fund research (including faculty salary and student support) which they deemed meritorious;
>
> * covering research "gaps" which may otherwise arise from blind spots at the Federal level;

* "aid" to institutions which undertake Federally-supported, mission-related research without distorting their idea of balanced academic research;

* provide "start-up" funds to test out new ideas not sufficiently advanced to compete for project grant support;

* strengthening the hand of the institutions' administrators by giving them direct control of some research funds; and

* providing another source of indirect support to the education role of health professions schools.

However, at the present time the direct institutional support for education is on the increase and growth in biomedical research will be for selected research areas. Thus there is a need to reexamine general support for biomedical research through the general research support grant mechanisms of the NIH/NIMH.

The analysis should indicate:

1. The objectives of the program and the extent to which the objectives have been approximated through prior allocations. The likely impact of reductions on the GRS level in the future.

2. A comparative assessment of the quality of research under GRS compared to that under the project grant mechanism.

3. The advantages and disadvantages of distributing research funds under GRS when high quality project grants go unfunded.

4. The impact of distributing GRS funds on a formula basis (level of project grants): does it tend to go to a limited number of first-rate research institutions rather than to help develop new or weak research institutions.

5. Alternatives to the current separate GRS mechanism."

This paper represents the NIH response to the issue stated above.

The paper has been developed under the following assumptions:

1. That biomedical research will continue to be supported primarily by project-type grants.

2. That the general level of NIH-NIMH support of research will be that projected in the Program and Financial Plan.

3. That the institutional community in which the research is supported will continue to be of approximately the same composition as it is now.

Recognition of the Need for General Support of Biomedical Research

Biomedical research has been supported by project grants for many years. However, responsible Federal officials, investigators, and educators recognized early that the success and effectiveness of a research project are a function not only of the investigator's qualifications but also of the physical and human environment in which he works, factors that are controlled by the institution rather than by the investigator. Consequently, the needs and methods for strengthening institutions in order to improve the quality of biomedical research conducted in them were studied by several groups.

In response to a request made by Secretary of Health, Education, and Welfare, Oveta Culp Hobby, the National Science Foundation sponsored a study of medical research activities of DHEW by a committee of consultants headed by Dr. C. N. H. Long. The report of the Long Committee, submitted in December, 1955, recommended, inter alia, that unrestricted, long-term institutional grants be awarded to assist in the conduct of medical research and training.

Secretary of Health, Education, and Welfare, Marion Folsom, appointed a committee of consultants on medical research and education under the chairmanship of Dr. Stanhope Bayne-Jones. The final report of the Committee, The Advancement of Medical Research and Education, dated June 27, 1958, included the following conclusions and recommendations:

"A. Balance Among Goals

Efficient and wise administration of the extramural program of the National Institutes of Health depends not upon identification and attainment of a simple set of objectives, but upon maintenance of a sound balance between goals which are often equally desirable and mutually exclusive.

"1. The Individual and the Institution

Maintenance of the freedom of the individual scientist to follow his own leads and pursue his own interests, and provision in the administrative process for effective expression of views by spokesmen for the individual scientist, are important objectives in administration of a grant program. The value of the project grant should not be underestimated as a means of preserving the opportunity for the individual scientist to secure support for what he wishes to do. However, research and training funds must be provided under conditions which permit universities, medical schools, dental schools, other medically-related institutions and hospitals to establish institutional goals, to secure balance among their many schools and departments, and to set their own standards of excellence.

The NIH grant programs, and particularly the research grants, have in the past given primary consideration to the needs of the individual research workers.

The Consultants recommend that:

Increasing attention be given to the effects of research and training grants upon institutions as a whole.

* * * * * * * * *

"4. Immediate Returns and Long-Range Investment--
Geographical Dispersion

In general, NIH research and training grants should be given to the individuals and the institutions best able to produce results of high quality. On the other hand, there is also a responsibility to take into consideration the development of the strength of the Nation's medical research system over the long run.

The Consultants recommend that:

The National Institutes of Health foster, with the close collaboration of interested organizations and institutions, the development of a geographically dispersed system of first-rate, non-Federal research institutions.

"B. Research Grants

Because research grants must meet a number of needs, the problem of designing a sound system for the future is complicated. It is much more subtle and difficult than is implied by proposals that the research grant system change completely from a 'project' to a 'block grant' approach.

The needs to be met are not only comples, but shifting. Since the forms in which funds are provided should be responsive to opportunities and needs, a complicated and changing system of grants should be expected. Nevertheless, recommendations as to the general path of evolution of the research grant programs can be made.

"3. Base Grants Initiated

An increase in the capacity of research and educational institutions to perform their educational and research functions more effectively would be in the national interest. To this end, Federal funds for research should be provided under conditions which give the institutions a substantial degree of freedom in deciding how to use the funds. The essential function of such funds is to foster freedom and responsibility in the institutions. This kind of grant should be carefully designed to supplement project and program grants, and should be established only after extensive consultation and exploration.

The Consultants recommend that:

Base grants for research and training, distributed on the basis of professional judgments of the unique capacities and needs of each institutions and not made to finance specific projects or programs, be provided to institutions.

> The Consultants note specifically that the basic statute under which the Public Health Service makes research grants (sec. 301 of the Public Health Service Act) authorizes support of 'research projects.'
>
> The Consultants recommend that:
>
> If grants of the type recommended in this report are not authorized by law, statutory authority to make such grants be sought."

It was the opinion of the Bayne-Jones Committee that the essential function of the base grants would be "to foster freedom and responsibility in the institutions." This is consistent with the view of the Committee, stated earlier, that ". . .research and training funds must be provided under conditions which permit universities, medical schools, dental schools, other medically related institutions and hospitals to establish institutional goals, to secure balance among their many schools and departments, and to set their own standards of excellence. The NIH grant programs, and particularly the research grants, have in the past given primary consideration to the needs of the individual research workers. The consultants recommend that: Increasing attention be given to the effects of research and training grants upon institutions as a whole." Thus, the need for general research support is raised as a means of counteracting any lack of institutional freedom and responsibility inherent in the research project grant system. Taken in conjunction with the preceding encouragement to increase the capacity of institutions to perform their research functions, the reference to "freedom and responsibility" could mean that development of research capability is

an institutional responsibility and that each institution should have the freedom to determine the nature of its own development.

Concern over the limitation of research support to project grants was expressed again in 1958 by the President's Science Advisory Committee. In its report, Strengthening American Science, the Committee stated, "Program grants or institutional grants would permit more effective research in broad areas of science and provide greater freedom for the scientific community to give direction to the work undertaken. They might also prove to be an important administrative device for reducing the potential growth of Government administration if, otherwise, a greatly increased number of selecting and reviewing boards were necessary." The report recommended, "Institutional grants for specialized fields is another instrumentality that should be encouraged."

In its 1959 report, Physicians For a Growing America, the Surgeon General's Consultant Group on Medical Education, under the Chairmanship of Frank Bane, concurred in the recommendation of the Bayne-Jones Committee that base grants be established for research and training in the biomedical sciences.

An NIH staff paper entitled A Program of Institutional Research Grants, dated February 1, 1960, summarizes the background and need for general research support. It states that institutions, by virtue of project grants awarded to members of those institutions, are able to develop research programs in areas of interest to the donors of grants but are

unable to develop equally important research in other areas that are needed to give balance and breadth to their research and teaching programs.

The Subcommittee on Departments of Labor, and Health, Education, and Welfare of the Senate Committee on Appropriations appointed a Committee of Consultants on Medical Research. This Committee, headed by Mr. Boisfeuillet Jones, stated in its report, Federal Support of Medical Research, dated May 1960,

> "The general effect of the Federal program in support of medical research on the medical schools and research institutions of the country has been extremely beneficial and has enabled them to develop facilities and strengthen their faculties in a truly remarkable manner.
>
> There is concern, nevertheless, that the Federal program may produce some distortion in the teaching and research programs of medical schools and research institutions unless they are provided funds with which they can balance their research programs. The support of investigators by a Federal agency on an individual project basis, after review and approval by committees of experts, has been outstandingly successful and has been carried out with great wisdom and flexibility. This support, however, comes to the schools and research institutions through requests of individual investigators without regard for the overall plans of the institution and with conditions attached which may not fit into its program. This can lead to an uneven development which may not be in the best interests of the institution as a whole."

and it recommended,

> "In order to assure the effective utilization of the larger funds which will be required in the future, new administrative patterns for support of research must be developed. These should be employed according to the needs of the respective institutions

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"(b) Institutional Grants. The return of the responsibility for allocating research and training funds to the research institutions and medical schools of the country in the form of institutional grants will provide greater freedom to the institutions in building up their research services, in stabilizing their research programs, and in establishing additional stable career opportunities."

Establishment of General Research Support Authority by Public Law 86-798

Statutory authority for general research support was established on September 15, 1960, with the signing by President Eisenhower of Public Law 86-798 which is entitled, "An Act to amend the Public Health Service Act to authorize grants-in-aid to universities, hospitals, laboratories, and other public or nonprofit institutions to strengthen their programs of research and research training in sciences related to health." In this admittedly very limited area, this action presaged "The New Federalism" by a decade. President Nixon in his Address to the Nation on August 8, 1969, stated, "After a third of a century of power flowing from the people and states to Washington, it is time for a New Federalism in which power, funds, and responsibility will flow from Washington to the states and to the people." President Eisenhower thus brought to reality a program which did return the responsibility of allocating research and training funds to the local institutions themselves.

Since the implementation of the General Research Support Grant (GRSG) Program in 1962, the need for the program has continued to be documented. The Committee on Science and Public Policy, National Academy of Sciences, under the Chairmanship of George Kistiakowsky, published in 1964 its

report, Federal Support of Basic Research in Institutions of Higher Learning, which contains the following statement:

> "8. While we strongly endorse the project grant/contract system of research support, we believe that three auxiliary types of support are also necessary for the healthy growth of American science.
>
> (a) The first of these are institutional or general research grants related to existing totals of project grants, now being made on too modest a scale by the National Institutes of Health and the National Science Foundation. These should be strengthened and broadened in purpose to overcome serious imbalances created in the universities by the growth of existing project research support and to meet the need for initial support of new projects."

Also in 1964, the Select Committee on Government Research of the House of Representatives, in House Report No. 1938, 88th Congress, 2nd Session, Study Number VI, Impact of Federal Research and Development Programs, made the following recommendation:

> "6. The institutional grant system is an efficient complement to the project system, especially where broad Agency missions are involved . . . . The committee recommends its continuance."

The Committee on Science and Astronautics of the House of Representatives in House Report No. 1236, 89th Congress, 2nd Session, February 1, 1966, The National Science Foundation - Its Present and Future, recommended additional emphasis on institutional and developmental grants. "It is the consensus of the subcommittee that, in order to obtain an optimum effectiveness for the NSF research dollar, a greater effort must be made

to bring out the science potential - both teaching and research - in a larger number of institutions." This recommendation continues, "What is suggested is that as the Foundation's role expands, a greater proportion of its attention and support be given to the needs of institutions as such--both large and small in accordance with their individual capabilities."

These illustrations and the conclusions of the two studies that have evaluated the GRSG program (described in a subsequent section) emphasize the continuing need for institutional support, not only for biomedical research, but also for other fields of scientific research.

Early Operation of the General Research Support Grant (GRSG) Program

Policies and procedures for operating the GRSG program were developed and the first awards were made effective January 1, 1962. Eligibility during the first year was limited to schools of medicine, dentistry, osteopathy, and public health, each of which was automatically eligible and received a base grant of $25,000 plus a proportionate amount of remaining funds according to an entitlement formula based upon the amount of research expenditures during the previous fiscal year. Fifteen percent of the calculated amount was added for indirect costs. Entitlement for research expenditures from nonfederal grants, contracts, and gifts was set at ten percent of the first million dollars of such expenditures and six percent of the amount between $1 and $2 million. The comparable entitlement figures for such expenditures from Federal sources were five percent and three percent.

In 1963, the second year of the program, schools of pharmacy and veterinary medicine, hospitals, nonacademic research institutions, and state and local health departments became eligible provided the institution received at least $100,000 of NIH research grants the previous year, and provided the institution's total research activity was judged by the National Advisory Health Council (NAHC) to have diversity, complexity, and depth sufficient to indicate a considerable engagement in health-related research. The $25,000 base grant provision was extended to the schools of pharmacy and veterinary medicine, but not to the other categories of newly eligible institutions. Every institution entering the program after the first, including new schools of medicine, dentistry, osteopathy, and public health were required to establish eligibility.

Evaluation of the GRSG Program

After three years of operation, the Director, NIH, requested the National Academy of Sciences - National Research Council (NAS-NRC) to review and evaluate the purposes, design, and conduct of the GRSG program. The committee that conducted the study reported in 1965 that in general the program seemed to be effective and adequately administered. At that time, however, insufficient experience had accumulated to allow a definitive judgment of its value. The committee recommended that a thorough evaluation of the program's effectiveness be made after at least five years of experience. The recommended evaluation has been carried out by Sidney G. Roth, Director, Office of Sponsored Programs, New York University; and G. Robert Boynton, Professor of Political Science, University of Iowa. The Roth-Boynton findings and recommendations are described in a subsequent section.

Later Operation of the GRSG Program

Early experience in operating the GRSG program revealed administrative problems and inequities that warranted revision of the program. Although it was recognized that the Roth-Boynton study might well produce important recommendations for changes in the program, it was felt that revision could not wait for the conclusions of the study. Accordingly, the staff of the GRSB, with the assistance of other staff members of the Division and of the NIH as well as consultant groups, studied the problems and developed recommendations and modifications which were approved by consultants, the NAHC, and higher administrative levels of the PHS, DHEW, and BoB in the summer of 1968. The revised program was announced in August 1968 and implemented for the awards issued as of January 1, 1969. The major changes made were: (1) the termination of automatic eligibility, with the requirement that all applicants annually establish eligibility through the receipt of at least $100,000 of NIH and NIMH research grants; (2) termination of the $25,000 base grant to health professional schools; (3) replacement of the entitlement base of expenditures on which the awards had been computed with an entitlement base of research grants awarded by the NIH and NIMH during the preceding fiscal year; (4) the use of a new formula for computation of awards designed to reflect the above modifications but with minimal perturbations in the new awards to individual grantees.

Because it was recognized that termination of automatic eligibility and the change of entitlement base with elimination of expenditures from Federal sources other than the NIH and NIMH and from restricted nonfederal

sources would cause serious reductions in the eligibility and entitlement of some individual institutions, provisions were introduced for "phase out" awards to institutions that could not meet the eligibility requirement of $100,000 of NIH and NIMH research project grants by awarding each of them for 1969, 80 percent of the previous year's award, and for 1970, 50 percent of the 1969 award. For institutions that remained eligible but suffered major reductions, a "cushioning" provision was introduced, which assured each such institution that as a result of the redesign of the program its GRSG would not be reduced by more than 20 percent or $50,000 for 1969, and that for 1970 the award would again not be reduced by more than 20 percent or $50,000 from the 1969 level.

Establishment of the Biomedical Sciences Support Grant (BSSG) Program

In 1965, on the recommendation of the appropriations committees of the Congress, the BSSG program was implemented to provide to academic institutions other than health professional schools a fluid, formula-type award to support health sciences research programs in a manner analogous to that of the GRSG. On the basis of GRSG experience gained prior to that time, the administrative structure of this program was made simpler than that of the GRSG. In fact, it served as a prototype and guide for the subsequent modification of the GRSG program described above.

The BSSG program was intended to serve the same objective as the GRSG but for different categories of institutions. Operational procedures for The BSSG program differ from those of the GRSG program in that the eligibility threshold is $200,000 for BSSG grantees. Entitlement for BSSG

awards has been based on allowable NIH-NIMH research project grants since the beginning of the program. The formula for calculation of BSSG awards differs from that used for GRSG awards. Formulae for both programs are described in Table 50, page 112, and on pages 66 through 79.

Establishment of the Health Sciences Advancement Award (HSAA) Program

Senate Report No. 1460, Departments of Labor, and Health, Education and Welfare, and Related Agencies Appropriations Bill, 1965, Report from the Committee on Appropriations, 88th Congress, 2nd Session, August 17, 1964, stated:

> "The Committee would also like to see . . . a start at least made in 1965 in the use of general research support grants for institutional development purposes. The Committee has heard much testimony on the need to bring existing institutions to fuller realization of their potential for research excellence in the full complement of the sciences related to health research, with some regard also to suitable geographic distribution of these institutions."

This desire reflected the recommendations of other committees and expert witnesses. In response, the NIH initiated the Health Sciences Advancement Award Program in FY 1966 with awards to two institutions totalling one million dollars. These awards are intended to cover a non-renewable period of no more than five years at an approximate level of $500,000 per year. The awards are competitive and are made upon the recommendation of the Health Sciences Advancement Award Review Committee and the NAHC. The awards are for the support of a specifically described research program of excellence which will have the effect of bringing about a major upgrading of the biomedical research stature of the grantee

institution. The grantee must agree to carry on the enlarged program with other funds after the five-year award has ended.

OBJECTIVES OF THE GENERAL RESEARCH SUPPORT PROGRAM

Statement of the Objectives

General support of biomedical research by NIH was authorized in recognition of the necessity for giving institutions greater control over the quality, content, emphasis, and direction of their research activities than is possible with research project grants and other research and training support programs. The rationale is that effective health research requires a strong institutional base as well as direct project support. Three separate types of grants are being awarded under the General Research Support (GRS) Authority--the General Research Support Grants (GRSG), the Biomedical Sciences Support Grants (BSSG), and the Health Sciences Advancement Awards (HSAA). The GRSG and BSSG awards are made on a formula basis to institutions that qualify by involvement in health-related research and research training that is not less than a prescribed level. HSAA awards are based on competitive national peer review of proposals to accomplish specific institutional objectives.

The establishment of the HSAA program in 1966 represented a departure in the mechanisms for achieving GRS objectives. The primary motivating force for starting the HSAA program was a recognition on the part of congressional leaders, as well as the scientific and academic communities, of the desirability of increasing the number of institutions of excellence for conducting research and of improving their geographic

distribution in order to expand and strengthen the Nation's capability for research. It was perceived that the GRS authority was uniquely suited to providing the broad general type of support which was necessary to allow a limited number of highly qualified institutions to advance themselves into the ranks of the excellent. Because of increasingly serious fiscal constraints, it has become necessary to institute a moratorium on the acceptance of new applications for review in the HSAA program. Current plans are to phase-out the HSAA program as the periods of committed support for present awardees expire. Thus, treatment of the HSAA program here is not germane and the focus of discussion will be on the formula programs.

The initial and major aims of the GRS formula programs were to provide support of a general, flexible nature that would enhance biomedical research and training by improving and strengthening the setting in which the institutions pursue national health research objectives through project grants and contracts, and thereby serve as an indirect means of enabling the Federal Government to achieve specific disease-oriented missions. They are the principal elements in the total support system through which an institution can forge new directions, innovate programs, and support fledgling ideas and the people to develop them. Decisions concerning use of general research support funds were left to the grantee institutions to facilitate improvement in the research setting. Federal review and control seek to distribute general research support equitably and in ways that will be most effective, and to provide a means

of accountability to assure that funds are used properly, but do not extend to the detailed substance of the institutional programs. Funds are distributed among the institutions on a formula basis, and the institutions--within broad guidelines--determine the allocation among programs within the institutions. The NIH offers advice and works with the institutions to improve the quality of their programs, but does not substitute its judgment for that of the recipient institutions.

The GRSG program began with awards to all of the Nation's medical, dental, public health, and osteopathic schools. It was expected that these schools would be engaged in health research. If they were not, it was considered that they should be. Initially then, GRSG's were not made on a strictly merit basis, as all eligible institutions which applied, received base awards of $25,000 whether or not they were entitled to formula amounts computed on the basis of their research expenditures during the previous year. Base awards to institutions that expended little or no money for research were intended to encourage such institutions to develop their research capability.

The initial concepts of the operational objectives of the program were:*

> ". . . To support . . . research which the school's scientist-staffs and administrators, not an NIH council, elected to support . . . The support (provided) could be used with extraordinary effectiveness in undertaking completely new ventures

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*Stone, Frederick L., General Research Support Grants from the Standpoint of the National Institutes of Health. J. Med. Ed. 40: 338-339, April 1965.

that would have been quite difficult before, and . . . with the hope, if not the assumption, that traditional support would be forthcoming if the venture showed definite promise.
. . . To stabilize faculty salaries and to make it immediately possible to recruit new faculty members.
. . . To provide resources that cannot readily be obtained through individual grants, or which . . . could be provided more economically as central resources.
. . . To take over two ongoing programs of the NIH--the postsophomore fellowship (program) for medical students (and) the small grant program of $2,000 or less."

The Roth-Boynton Study

The most recent study of the characteristics of the GRSG program and its effectiveness in achieving its goals is the Roth-Boynton study mentioned previously. As a necessary prelude to this study, an exhaustive survey of the legislative and administrative history of the GRSG program was conducted for the purpose of reexamining and clearly delineating the objectives and subobjectives which had been assigned the program, and the operational means by which grantee institutions accomplish these objectives. This required searching the records covering the period in which the program was being conceptualized, during congressional consideration of authorizing legislation, during the development of program guidelines and regulations and during the early operational period. In addition, interviews were held with those individuals who played decisive roles in planning and implementing the program. This effort culminated in the following compilation which met with the approval of the knowledgeable and responsible program officials at the NIH.

1. The over-all objective

To advance (strengthen) the medical and health-related research and training programs of institutions through complementing the research project system by providing continuing funds to be used flexibly by the institution.

2. The subordinate purposes (subobjectives)

a. To cultivate scientific excellence through building institutional strengths.
b. To contribute to the stable support and development of its programs.
c. To enable an institution to balance its programs.
d. To enhance the institution's role and initiative in determining the direction of its programs.
e. To meet emerging opportunities in research via support of the pursuit of unorthodox ideas.
f. To enable earlier recognition and support of scientific talent.
g. To provide incentive to attract more nonfederal funds.
h. To add rather than supplant other support.

3. The institutional means or actions to achieve these ends

a. Providing support for pilot research studies, including funding for the exploration of novel ideas.
b. Providing support for young investigators.
c. Providing support for the development of research components of new programs and new departments.
d. Providing stable salary support.
e. Providing support for research services and resources.
f. Providing funds for unanticipated costs and those not met through project grants.

While these objectives were developed with specific reference to the General Research Support Grants, they apply equally to the Biomedical Sciences Support Grants (except for the attraction of nonfederal funds, 2.g.).

The Roth-Boynton study was made primarily by means of a questionnaire survey of grantee institutions supplemented by grantee annual reports. Since all the major health professional schools in the Nation were eligible

institutions and had received grants, there existed no control population of institutions. Consequently, an ex post facto study design was adopted in which the grantee institutions' uses of GRSG funds were retrospectively measured for their effects on the accomplishment of the overall objective and the several subobjectives of the program. Since it was important to determine not only whether the GRSG program had met its objectives, but also the effectiveness of its funds as compared to funds from project grants, the grantee institutions were asked to specify all sources and uses of funds for activities in which the GRSG monies were or might have been used. Thus if it could be determined that GRSG funds had been utilized to a greater degree than research project dollars to accomplish the stated purposes of the GRSG program, or in a way not possible with direct project support and the other funds available to the institution, the GRSG program would have to be judged effective. In other words, if the GRSG program met its goals "better" than other governmentally supported programs, and enabled participating institutions to meet their health research and research training goals, a justifiable conclusion would be that the GRSG program was accomplishing its purpose and that justification for continuance of the program at or near its legal authorization (15 percent of the NIH-NIMH research project budgets) level would be a logical and reasonable sequel.

In order to implement this strategy a survey instrument was developed in which each objective of the program was addressed by a set of questions designed to elicit the information required to determine whether the GRSG's were meeting the objectives which had been identified and whether they were

meeting them as well as other funds at the institution's disposal. This questionnaire would necessarily call forth responses which reflected decisions made by the administrators of the institutions. So that the impact of GRSG's on individual scientists could be determined, brief questionnaires were also sent to a random sample of staff members from a representative group of grantee institutions and also to all those scientists who were identified from the grantees' reports of expenditures as having been allocated more than $1,000 of GRSG funds in any one year.

Summary of the Major Findings in the 1969 Report (Roth-Boynton) on the GRSG Program Evaluation Study

The major findings listed below emerged from an analysis of the responses from 293 grantee institutions (Table 1) and from the responses of 5,423 professional scientists out of 9,200 that were queried.

1. Relationship of GRSG Monies to Total Operating Costs

   Among the institutions surveyed, GRSG funds represented less than 2 percent of their total operating expenditures and approximately 5 percent of their Federal health funds (Table 2)

2. Relationship of GRSG Monies to Total Research Project Spending

   Expenditures for health research projects by the GRSG awardees from all sources increased 16.9 percent annually from 1960-61 to 1966-67. GRSG dollars contributed less than 10 percent of the increase. Federal research support was greater than the sum of research support from all other sources, and increased at a greater rate over this period than any other support element (Tables 3, 4, and 5). During 1966-67, GRSG expenditures amounted to 5.8 percent

TABLE 1

NUMBER OF INSTITUTIONS RESPONDING TO THE SURVEY QUESTIONNAIRE

Medical Schools	Dental Schools	Other Schools*	Hospitals	Other Research Organizations	Total Number Responding**	Total Number of Grantees
89	49	39	65	51	293	294

* Includes 5 Schools of Osteopathy, 9 Pharmacy, 13 Veterinary Medicine, and 12 Public Health.

** One Medical School did not respond.

TABLE 2

RELATIONSHIP OF GRSG FUNDS TO TOTAL OPERATING COSTS FOR 293 GRANTEE INSTITUTIONS, 1966-67
(in thousands of dollars)

	Dollars	Percent of Total	Percent of Federal
Total Operating Costs*	$2,134,379	100.0	-
Federal Funds	767,372	35.9	100.0
GRSG Research Funds	39,196	1.8	5.1

*Excluding capital expenditures.

TABLE 3

GRANTEE EXPENDITURES FOR RESEARCH PROJECTS BY SOURCE OF FUNDS: 1960-61 and 1966-67
(in thousands of dollars)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Total Amount	Total Average Annual Compound Rate of Increase
Federal (excluding GRSG)							
1960-61	$122,911	$ 3,957	$11,148	$19,765	$15,107	$172,888	
1966-67	324,875	10,161	34,278	59,272	46,694	475,280	17.7%
General Research Support Grant (GSRG)							
1966-67	22,946	2,283	3,531	5,959	4,864	39,583	-
State and Local							
1960-61	4,956	12	1,115	694	1,694	8,471	
1966-67	11,436	68	1,459	2,759	2,704	18,426	13.9%
Voluntary Health Agencies, Foundations, Industry							
1960-61	35,689	735	2,692	6,442	8,798	54,356	
1966-67	54,142	1,821	3,907	11,220	13,252	84,342	7.6%
Institutional Funds							
1960-61	13,443	375	3,334	9,210	5,138	31,500	
1966-67	27,457	1,656	5,679	17,589	12,256	64,637	12.7%
Total							
1960-61	$176,999	$ 5,079	$18,289	$36,111	$30,737	$267,215	
1966-67	$440,856	$15,989	$48,854	$96,799	$79,770	$682,268	16.9%

TABLE 4

AVERAGE ANNUAL COMPOUND RATE OF CHANGE IN GRANTEE AVERAGE EXPENDITURES FOR RESEARCH PROJECTS: 1960-61 TO 1966-67

Fund Source	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Federal (excluding GRSG)	16.9%	13.6%	20.6%	18.1%	16.9%
(including GRSG)	18.2%	17.6%	22.6%	20.0%	19.1%
State and Local	9.5%	26.2%	-1.2%	14.5%	3.1%
Voluntary Health Agencies, Foundations, and Industry	6.8%	12.0%	5.4%	7.5%	4.2%
Institutional	11.2%	19.8%	7.8%	8.6%	0.1%

TABLE 5

AVERAGE EXPENDITURE PER RESPONDENT FOR RESEARCH PROJECTS
(in thousands of dollars)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Total Amount	Total Average Annual Compound Rate of Increase
Federal (excluding GRSG)							
1960-61	$1,463.2	$ 96.5	$ 318.5	$ 346.8	$ 359.7	$ 667.5	
1966-67	3,734.2	207.3	979.4	940.8	915.6	1,604.4	15.7%
State and Local							
1960-61	112.6	2.4	65.6	53.4	188.2	96.3	
1966-67	193.8	9.7	60.8	120.0	225.3	148.6	7.5%
Voluntary Health Agencies, Foundations, Industry							
1960-61	424.9	21.0	79.2	119.3	225.6	210.9	
1966-67	629.6	41.4	108.5	183.9	288.1	308.9	6.6%
Institutional Funds							
1960-61	244.4	20.8	138.9	244.6	359.0	211.4	
1966-67	450.1	61.3	218.4	359.0	360.5	328.1	7.6%
General Research Support Grants (GRSG)							
1966-67	266.8	48.6	100.9	96.1	110.5	144.5	-

of all research project spending. The average percentage by class of institution ranged from 5 percent to 14 percent (Table 6).

3. Institutional Policies for Allocating GRSG Funds

Four out of five grantee institutions have GRSG policies to guide their allocation of GRSG funds. Of those with policies, more than 60 percent are written (Table 7). The provisions of these policies cover the expected spectrum of research and research training activities with major emphasis upon the support of staff salaries, research projects, research training, and central resources. The pattern of policy implementation shows that, as the major mechanism for the allocation of funds, a committee of local peers was used by 84.1 percent of the grantees with unwritten policies and by 90.9 percent with written policies (Table 8).

4. Major Impact of GRSG Funds

Participating institutions believed that the GRSG program's principal contribution was to meet emerging opportunities in research, especially through the support of unorthodox ideas. This contribution was cited most frequently in an open-ended question (by 126 respondents out of the 293 surveyed). As Table 9 shows, the next most frequently cited contributions were the usefulness of the GRSG funds to stimulate and sustain research and the early recognition of talent through support of students, trainees, and fellows.

TABLE 6

GRSG EXPENDITURES RELATIVE TO ALL RESEARCH PROJECT SPENDING AT 293 GRANTEE INSTITUTIONS, 1966-67

(in thousands of dollars)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Total
Total Expenditures	$440,856	$15,989	$48,854	$96,799	$79,770	$682,268
GRSG (Dollars)	22,946	2,283	3,531	5,959	4,864	39,583
GRSG (Percent)	5.2%	14.2%	7.2%	6.1%	6.0%	5.8%

TABLE 7

NUMBER AND PERCENT OF GRANTEES WITH WRITTEN POLICY STATEMENTS FOR ALLOCATION OF GRSG FUNDS

	Number	Percent
Grantees with		
Written Policy	143	61.9
Unwritten Policy	88	38.1
Total	231	100.0

TABLE 8

THE USE OF COMMITTEE RECOMMENDATIONS FOR IMPLEMENTING GRSG POLICIES*

Type of Institution	With Written Policy	Faculty or Equivalent Committee Recommends		With Unwritten Policy	Faculty or Equivalent Committee Recommends	
		No.	%		No.	%
Medical Schools	43	41	95.3	28	26	92.9
Dental Schools	27	26	96.3	15	14	93.3
Other Schools	21	19	90.5	10	7	70.0
Hospitals	37	30	81.1	10	9	90.0
Other Research Institutions	15	14	93.3	24	18	75.0
Totals	143	130	90.9	88	74	84.1

*Three institutions stated they had a formal policy but did not indicate whether it was written or unwritten.

TABLE 9

NUMBER AND PERCENT OF GRSG CONTRIBUTIONS
CITED MOST FREQUENTLY BY GRANTEE INSTITUTIONS

Contributions	Total Citations	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Meeting Emerging Opportunities						
Number	126	39	25	15	30	17
Percent	43.0	43.8	51.0	38.5	46.2	33.3
Stimulate and Sustain Research						
Number	119	31	27	17	26	18
Percent	40.6	34.8	55.1	43.6	40.6	35.3
Early Recognition of Talent						
Number	115	44	33	16	11	11
Percent	39.2	49.4	67.3	41.0	17.2	21.5

Among the GRSG contributions cited by the responding institutions was a set of values characterized as "virtues" which are not generally identified with project grants. Each respondent had to mention these "virtues" explicitly rather than check off items on a list.

The three most frequently mentioned major virtues of the GRSG were the facilitation of institutional growth and development, the ability to support innovative ideas, and the flexibility of the available funds. Facilitating institutional growth and development was mentioned almost twice as often as any other contribution of this type (Table 10).

Although mentioned less frequently by respondents as a "virtue," local control of the decision process for allocating GRSG funds is an essential element for accomplishment of the major "virtues" cited above.

5. Relationship of Research Projects with Major or Sole Support from GRSG Funds to All Research Projects in 1966-67

In 1966-67, GRSG funds provided major or sole support for 9.6 percent of all research projects at medical schools, and for 41.7 percent of all research projects at dental schools. Comparable figures for the other categories of grantee institutions lie between these limits (Tables 11 and 12).

6. Comparison of GRSG Funding of Pilot Research Projects to All Research Projects

Pilot projects represented from 9 percent of all projects at medical schools to 28.1 percent at dental schools in 1966-67 (Table 13). Pilot projects with GRSG as the major source of funding numbered 1,994, which was 59 percent of all pilot projects. GRSG

TABLE 10

NUMBER AND PERCENT OF GRSG "VIRTUES"
CITED MOST FREQUENTLY BY GRANTEE INSTITUTIONS

Virtues	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Totals
Facilitation of Growth						
Number	32	8	10	14	13	77
Percent	36.0	16.3	25.6	21.5	25.5	-
Facilitation of Innovation						
Number	13	8	10	9	4	44
Percent	14.6	16.3	25.6	13.8	7.8	-
Flexibility of Funds						
Number	20	5	3	11	5	44
Percent	22.5	10.2	7.7	16.9	9.6	-

TABLE 11

RELATIONSHIP OF PROJECTS WITH MAJOR* OR SOLE GRSG SUPPORT TO ALL RESEARCH PROJECTS, 1966-67

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Number of Research Projects With Major or Sole GRSG Support/Total Number of Research Projects	9.6%	41.7%	21.5%	17.2%	14.1%
GRSG Funds for Research Projects With Major or Sole GRSG Support/Total Funds for Research Projects	2.0%	10.2%	4.5%	4.5%	3.2%

* Major support is defined as more than half when there are two sources of support, more than one-third when there are three sources of support, etc.

TABLE 12

AVERAGE NUMBER OF RESEARCH PROJECTS RECEIVING MAJOR* OR SOLE SUPPORT FROM GRSG, 1966-67, AND AVERAGE AMOUNTS OF SUPPORT FOR SUCH PROJECTS FROM GRSG AND OTHER SOURCES
(in thousands of dollars)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Total					
Number of Projects	28.4	13.4	11.5	12.5	6.7
Amount of GRSG Support	$96.2	$30.4	$48.8	$68.2	$45.2
Amount of Other Support	$29.0	$ 9.4	$15.6	$41.7	$14.2
Greater Than $10,000					
Number of Projects	2.1	0.6	1.2	2.1	1.7
Amount of GRSG Support	$37.8	$ 5.3	$20.4	$36.4	$33.9
Amount of Other Support	$ 9.9	$ 1.7	$ 7.9	$23.7	$13.3
Equal To or Less Than $10,000					
Number of Projects	26.3	12.8	10.4	10.3	5.0
Amount of GRSG Support	$58.9	$25.1	$28.4	$31.8	$11.3
Amount of Other Support	$19.1	$ 7.7	$ 7.6	$18.0	$ 0.9

*See Table 11 for definition of major support.

TABLE 13

COMPARISON OF PILOT PROJECTS TO ALL RESEARCH PROJECTS, 1966-67

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
AVERAGE NUMBER					
Pilot Research	25.3	8.6	10.8	9.9	7.3
All Research	280.8	30.6	53.7	70.9	45.6
Percent Pilot/All	9.0%	28.1%	20.1%	14.0%	16.0%
AVERAGE EXPENDITURES (in thousands of dollars)					
Pilot Research	$ 128.5	$ 20.7	$ 47.5	$ 64.1	$ 40.6
All Research	$4,591.4	$296.9	$1,073.7	$1,489.9	$1,356.0
Percent of Expenditures Pilot/All	2.8%	7.0%	4.4%	4.3%	3.0%

funds accounted for 78 percent of expenditures for those 1,994 pilot projects (Table 14). Early beginning of research by pilot studies was undertaken by 15.8 percent of 3,200 scientists who received more than $1,000 in GRSG support. This support was provided at a critical time for 12.7 percent of the same group of scientists. An indication of the scientific competence of the 3,200 scientists is the finding that 83.9 percent were principal investigators for sponsored research projects (Table 15).

7. Relationship of Research Projects with Less than Major Support from GRSG Funds to All Research Projects in 1966-67

The 2,937 research projects in 1966-67 that received less than major support from the GRSG program represented 8.6 percent of all health research projects at the 293 grantee institutions, for which GRSG supplied $11,476,000 to complement $79,858,000 from other sources (Tables 16 and 17).

8. Role of GRSG funds Relative to Initial and Interim Support of Research Activities

Institutions frequently used GRSG funds as interim support for research projects that eventually competed successfully for support from regular Federal or nonfederal sources. As Tables 18 and 19 show, 189 of the 293 institutions surveyed reported that their funding of programs with GRSG monies resulted, over a 5-year period, in $57,546,000 in additional nonfederal support. During the same period, $90,928,000 in additional Federal research support was attracted by 135 GRSG grantee institutions.

TABLE 14

PILOT PROJECTS AT GRSG INSTITUTIONS, 1966-67

Size of Pilot Project	Total Pilot Projects	Pilot Projects With Sole or Major Support from GRSG	Percent of Pilot Projects With Sole or Major Support from GRSG
> $10,000	403	98	24%
< 10,000	2,998	1,896	63
TOTAL	3,401	1,994	59%

Pilot Projects With Major or Sole Support From GRSG

Size of Pilot Project	Number	GRSG Expenditures	Expenditures From Other Sources	GRSG Expenditures as Percent of Total Expenditures
> $10,000	98	$1,310,000	$ 437,000	75%
< 10,000	1,896	3,882,000	1,030,000	79
TOTAL	1,994	$5,192,000	$1,464,000	78%

TABLE 15

SURVEY OF SCIENTISTS KNOWN TO HAVE RECEIVED AT LEAST $1,000 IN GRSG SUPPORT

	Scientists Surveyed	Respondents	Principal Investigators*	Support Provided at Critical Time	Support Enabled Early Start of Research
Number	4,894	3,200	2,686	408	506
Percent of Respondents	-	100%	83.9	12.7	15.8

* Principal investigators for sponsored research projects.

TABLE 16

RESEARCH PROJECTS WITH LESS THAN MAJOR* SUPPORT FROM GRSG, 1966-67
(in thousands of dollars)

Number of Projects	Expenditures			Average Expenditure Per Project		
	GRSG	Other	Total	GRSG	Other	Total
2937	$11,476	$79,858	$91,334	$3.9	$27.2	$31.1

*See Table 11 for definition of major support.

TABLE 17

AVERAGE NUMBER OF RESEARCH PROJECTS RECEIVING LESS THAN MAJOR* SUPPORT FROM GRSG, 1966-67, AND AVERAGE AMOUNTS OF SUPPORT FOR SUCH PROJECTS FROM GRSG AND OTHER SOURCES
(in thousands of dollars)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Number of Projects	22.0	4.4	8.3	6.1	7.7
Amount of GRSG Funds	$ 79.6	$ 9.5	$ 23.4	$ 37.7	$ 38.5
Amount of Other Support	$549.4	$38.9	$220.5	$202.6	$342.2

*See Table 11 for definition of major support.

TABLE 18

FEDERAL SUPPORT GENERATED BY GRSG-FUNDED RESEARCH
(1962-67)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Totals
Number of Institutions	54	17	17	26	21	135
Number of Citations	513	95	111	164	169	1,C52
Citations Reported with Funds	230	38	63	87	80	498
Sum Generated	$61,409,000	$3,357,000	$7,434,000	$11,262,000	$7,466,000	$90,928,000
Mean Per Institution	$ 1,137,200	$ 197,470	$ 437,290	$ 433,150	$ 355,520	-
Overall Mean Per Funded Citation	$ 267,000	$ 88,340	$ 118,000	$ 129,450	$ 93,320	-

TABLE 19

NONFEDERAL SUPPORT GENERATED BY GRSG-FUNDED RESEARCH
(1962-67)

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions	Totals
Number of Institutions	66	31	24	42	26	189
Number of Citations	344	77	86	139	148	794
Citations Reported With Funds	242	67	73	116	65	563
Sum Generated	$32,891,000	$1,667,000	$11,139,000	$7,712,000	$4,137,000	$57,546,000
Mean Per Institution	$ 498,350	$ 53,700	$ 464,130	$ 183,620	$ 159,120	-
Overall Mean Per Funded Citation	$ 135,910	$ 24,880	$ 152,590	$ 66,480	$ 63,650	-

9. Impact of GRSG-Funded Research Training

GRSG trainee support has been used principally for medical and dental students, with a heavy emphasis on research training and experience during summers and other short periods of time for the purposes of enhancing the competence of such students in clinical practice and of identifying a small percent of students who have the talent for becoming the future teacher-investigators in health professional schools, hospitals, and research institutions. In 1962-63 14.8 percent of GRSG funds were used for trainee support; in 1967-68 it was 5.7 percent. The total number of trainees supported in 1966-67 by GRSG funds was 3,312, of which 3,066 were supported for periods of less than eight months. Ninety-four percent of medical and dental schools used GRSG funds to support 1,880 summer trainees and 878 short term trainees at other times during 1966-67 (Tables 20 and 21).

10. Strenthening Institutions Through Faculty Salary Support

More than 70 percent of the 90 medical schools used GRSG funds for salary support. Twenty-six percent of the 39 schools of osteopathy, pharmacy, public health, and veterinary medicine (other schools) used GRSG in this way. Approximately 50 percent of 165 dental schools, hospitals, health departments, and other research institutions stabilized their development in this fashion (Table 22).

TABLE 20

NUMBER OF GRSG SUMMER[1/] TRAINEES SUPPORTED DURING 1967
BY PERCENT OF TIME IN TRAINING, CLASS OF INSTITUTION AND ACADEMIC LEVEL

Academic Level Code[2/]	CLASS OF INSTITUTION											
	Medical Schools		Dental Schools		Other Health Professional Schools		Hospitals		Other Research Institutions		All Institutions	
	PERCENT OF TIME											
	100%	Less Than 100%	100%	Less Than 100%	100%	Less Than 100%	100%	Less Than 100%	100%	Less Than 100%	100%	Less Than 100%
1	51	4	4	-	16	-	14	1	4	-	89	5
2	1,478	88	183	32	31	3	18	-	14	-	1,724	123
3	19	1	8	2	-	-	2	-	3	-	32	3
4	2	1	7	-	5	-	-	-	7	-	21	1
Total All Academic Levels	1,550	94	202	34	52	3	34	1	28	-	1,866	132

1/ Summer: June, July, August (1, 2, or 3 months in training)

2/ Academic Level Code:
1 = Students seeking academic degree (pre-Bacc, pre-MS, MA, pre-Ph.D., etc.)
2 = Students seeking professional degree (pre-MD, DDS, etc.)
3 = Post-BA: not seeking degree
4 = Other: no degree held or sought, or not stated

TABLE 21

NUMBER OF FULL-TIME[1/] AND PART-TIME GRSG TRAINEES DURING 1967
BY CLASS OF INSTITUTION AND ACADEMIC LEVEL

Academic Level Code[2/]	CLASS OF INSTITUTION											
	Medical Schools		Dental Schools		Other Health Professional Schools		Hospitals		Other Research Institutions		All Institutions	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full time	Part-time	Full-time	Part-time	Full-time	Part-time
1	89	120	2	9	48	57	1	19	4	8	144	213
2	48	2,126	6	403	6	125	-	25	-	14	60	2,693
3	17	60	-	21	-	1	17	21	8	21	42	124
4	-	8	-	11	-	10	-	-	-	7	-	36
Total All Academic Levels	154	2,314	8	444	54	193	18	65	12	50	246	3,066

1/ Full-time: Appointment is for at least 8 months with 100 percent effort
Part-time: Appointment is for less than 8 months regardless of level of effort

2/ Academic Level Code:
1 = Students seeking academic degree (pre-Bacc, pre-MS, MA, pre-Ph.D., etc.)
2 = Students seeking professional degree (pre-MD, DDS, etc.)
3 = Post-BA: not seeking degree
4 = Other: no degree held or sought, or not stated

TABLE 22

STABILIZING INSTITUTIONAL DEVELOPMENT THROUGH STAFF SALARY SUPPORT, 1966-67

	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Institutions
Use GRSG Funds for Salary Support	70.8%	46.9%	26.4%	46.0%	47.1%
Number of Staff Supported	1,160	95	347	196	130
Mean Number of Staff Supported	20	4.3	43.4	6.8	5.7
Included in Grantees' GRSG Policy	33.7%	30.6%	22.2%	25.4%	16.0%
Included in Grantees' Long-Range Goals	26.9%	22.4%	15.8%	20.6%	15.7%
Grantees See it as a Major Contribution of GRSG	31.4%	26.6%	26.3%	31.8%	33.4%

11. Impact of the GRSG Program on Strengthening Institutions through the Support of New and Existing Entities (Programs, Departments, or Central Resources)

GRSG program impact relating to all sources of support was measured in terms of creating new activities and of supporting existing activities. Each of the above categories is further subdivided into strong or weak research areas. The following schema should be kept in mind in reviewing these areas of GRSG impact:

a. Creation of new entities to strengthen already strong areas of research.

b. Creation of new entities to strengthen weak areas of research.

c. Support of existing entities to strengthen already strong areas of research.

d. Support of existing entities to strengthen weak areas of research.

a. Creation of new entities to strengthen already strong areas of research

The GRSG funds supported the creation of more new entities to strengthen institutions than any other source. Thus, 184 institutions established 686 new departments, programs, or central resources; GRSG funds were used by 161 institutions in establishing 481 of the 686, with GRSG being a primary source (over 50 percent) of funds in 32.5 percent of the new entities. Other institutional and NIH research project funds each were a primary source of support in only 16.2 percent and 24.0 percent, respectively (Tables 23 and 24).

TABLE 23

NEW ENTITIES* ESTABLISHED, 1962-67, TO STRENGTHEN STRONG INSTITUTIONAL RESEARCH AREAS

	Without GRSG Funds		With GRSG Funds		TOTALS	
	Institutions	Entities	Institutions	Entities	Entities	Expenditures (in thousands of dollars)
Medical Schools	29	90	56	191	281	$ 67,773
Dental Schools	15	27	24	52	79	16,263
Other Schools	10	16	16	39	55	11,441
Hospitals	23	41	40	107	148	51,358
Other Research Institutions	13	31	25	92	123	16,787
Totals	90	205	161	481	686	$163,622

* New programs, departments, or central resources

TABLE 24

PRIMARY FUNDING SOURCE (AT LEAST 50 PERCENT)
FOR NEW ENTITIES FOR STRENGTHENING INSTITUTIONS
(with GRSG Funds)

	Institutional	GRSG	NIH Research Project	Other Federal	State and Local	Other
Medical Schools	14%	29%	31%	4%	1%	7%
Dental Schools	30%	38%	17%	2%	0%	2%
Other Schools	21%	41%	8%	13%	0%	3%
Hospitals	10%	29%	26%	6%	4%	9%
Other Research Institutions	18%	37%	18%	1%	1%	9%

b. Creation of new entities to strengthen weak areas of research

Explicit in the provisions of GRSG policies at 25 percent of the institutions surveyed were statements which provided administrators with the incentive, and at least partial means, for strengthening weak areas of research (balancing the total research program) at their institution. However, more than two-thirds of these institutions indicated that this was a major contribution of the GRSG to their institution. Thus, 185 institutions created 546 new departments, programs, or central resources to balance the institution, and GRSG funds were used as part of the total for 397 of these new entities in 162 institutions. GRSG funds represented the largest single primary source for these new entities in each institutional class except among medical schools where it was a close second to NIH research project funds (Tables 25 and 26).

c. Support of existing entities to strengthen already strong areas of research

More GRSG funds were used to support existing programs, departments, and central resources to strengthen already strong areas of research than to bolster relatively weak areas. These funds seemingly did not displace other sources but rather were used selectively. Sixty percent of the responding institutions reported "building areas of strength" as part of their GRSG policy. Seventy-seven percent believe that GRSG has made a significant contribution toward meeting this objective. Thus,

TABLE 25

NEW ENTITIES* ESTABLISHED, 1962-67, TO BALANCE** AN INSTITUTION'S TOTAL RESEARCH PROGRAM

	Without GRSG Funds		With GRSG Funds		T O T A L S	
	Institutions	Entities	Institutions	Entities	Entities	Expenditures (in thousands of dollars)
Medical Schools	28	54	52	141	195	$ 53,538
Dental Schools	10	15	20	36	51	7,545
Other Schools	6	10	18	38	48	23,154
Hospitals	20	44	40	106	150	44,432
Other Research Institutions	16	26	32	76	102	19,162
Totals	80	149	162	397	546	$147,831

* New programs, departments, or central resources

** Strengthen weak areas or to fill in gaps in an institution's research program

TABLE 26

PRIMARY FUNDING SOURCE (AT LEAST 50 PERCENT)
FOR NEW ENTITIES FOR BALANCING* INSTITUTIONS
(with GRSG Funds)

	Institutional	GRSG	NIH Research Project	Other Federal	State and Local	Other
Medical Schools	10%	30%	31%	1%	3%	6%
Dental Schools	16%	34%	16%	13%	0%	3%
Other Schools	3%	28%	14%	11%	3%	3%
Hospitals	12%	32%	24%	4%	2%	6%
Other Research Institutions	16%	34%	22%	3%	1%	4%

* Strengthen weak areas or to fill in gaps in an institution's research program

193 institutions strengthened 848 existing entities (departments, programs, and central resources); GRSG funds were used to strengthen 703 of the 848 entities in 177 of the institutions. NIH project funds were prominent as the primary source of support over the five years studied. Correspondingly, GRSG funds were less of a primary source for these existing entities than for new entities (Tables 27 and 28).

d. Support of existing entities to strengthen weak areas of research

Fewer dollars were spent on existing weak entities which were believed to require upgrading than were spent on existing entities which were regarded as strong research areas. Thus, 159 institutions spent $372,508,000 in five years to balance 478 entities, i.e., to strengthen weak research areas. Except for dental schools, NIH project grants were the primary source of these funds (NIH project grants were also the primary source of funds to strengthen already strong areas); GRSG was the primary source of funds for institutional balancing in dental schools (Tables 29 and 30).

12. Decentralization of Decision-Making Processes and Institutional Initiative

The distinctive characteristic of a GRSG is that it provides funds that can be used at the discretion of the local institution. GRSG funds, because they can be used flexibly, can serve as the financial basis for institutional decisions about innovations and

TABLE 27

STRENGTHENING EXISTING STRONG ENTITIES*
WITHIN AN INSTITUTION

	Without GRSG Funds		With GRSG Funds		TOTALS	
	Institutions	Entities	Institutions	Entities	Entities	Expenditures (in thousands of dollars)
Medical Schools	24	105	65	406	511	$548,714
Dental Schools	7	9	26	62	71	26,037
Other Schools	4	4	19	50	54	53,332
Hospitals	10	13	38	111	124	72,549
Other Research Institutions	9	14	29	74	88	45,457
Totals	54	145	177	703	848	$746,089

* Programs, departments, or central resources

TABLE 28

PRIMARY FUNDING SOURCE (AT LEAST 50 PERCENT)
FOR EXISTING STRONG ENTITIES
(with GRSG Funds)

	Institutional	GRSG	NIH Research Project	Other Federal	State and Local	Other
Medical Schools	9%	4%	56%	3%	2%	5%
Dental Schools	12%	25%	35%	10%	2%	0%
Other Schools	14%	10%	28%	10%	4%	8%
Hospitals	7%	9%	48%	4%	2%	9%
Other Research Institutions	20%	9%	54%	3%	0%	6%

TABLE 29

BALANCING* EXISTING RESEARCH AREAS

	Without GRSG Funds		With GRSG Funds		TOTALS	
	Institutions	Entities	Institutions	Entities	Entities	Expenditures (in thousands of dollars)
Medical Schools	12	31	46	202	233	$248,384
Dental Schools	4	4	19	47	51	9,825
Other Schools	2	2	16	40	42	43,074
Hospitals	6	6	36	77	83	45,904
Other Research Institutions	7	12	21	57	69	25,321
Totals	31	55	138	423	478	$372,508

* To strengthen weak areas in an institution's research program

TABLE 30

PRIMARY FUNDING SOURCE (AT LEAST 50 PERCENT)
FOR BALANCING* EXISTING RESEARCH AREAS
(with GRSG Funds)

	Institutional	GRSG	NIH Research Project	Other Federal	State and Local	Other
Medical Schools	10%	5%	55%	2%	1%	3%
Dental Schools	10%	37%	27%	5%	0%	7%
Other Schools	18%	5%	29%	13%	3%	0%
Hospitals	16%	18%	27%	7%	1%	6%
Other Research Institutions	13%	9%	49%	2%	9%	2%

* To strengthen weak areas in an institution's research program

development. In the annual reports of the institutions, in talking to the research administrators of grantee institutions, and in the data collected for the Roth-Boynton study, this is the dominant theme that underlies all description and evaluation of the GRSG program. The ways in which GRSG support is significant differs from one class of institution to another, but there is at least one common factor--its importance far transcends the dollar input. Contributions of the GRSG program cited by the grantee institutions indicated that the general freedom permitted institutions through the GRSG program is as important as its substance.

Interpretation of the Major Findings of the Roth-Boynton GRSG Program Evaluation Study

The GRSG program shares the major substantive goals of all other health-related research and research training programs--better health through generation of new knowledge leading to the prevention and cure of disease, and to optimal human growth and development. The unique and major strength of the GRSG program lies not in what the program tries to accomplish in terms of specific or mission-oriented research or research training but in the flexibility provided to institutions and their scientist-administrators to interpret their own most pressing needs at any given time, and to act at the most opportune time and in the most effective way to meet these needs.

The Roth-Boynton study sought to determine the extent to which goals of the GRSG were being met with GRSG funds, and to compare this with the extent to which other sources of funds also contribute to meet these goals. The study showed where the GRSG program contribution was

distinctive when compared with other sources of funds for accomplishing each sub-objective listed on page 22.

The first sub-objective is "to cultivate scientific excellence through building institutional strengths." The Roth-Boynton study provides clear indication of the wide-reaching impact of GRSG in strengthening areas that are already strong. Although the GRSG was only a small percentage of the total budget, it was important because it could be used to meet very specific needs for which no other funds were available. "GRSG was a crystal element in establishing new entities and provided a necessary supplement in strengthening existing (entities)."

The second sub-objective is "to contribute to the stable support and development of (institutional research) programs." Salary support is the major way that GRSG funds are used for this sub-objective. Seventy percent of the medical schools and almost half of most other categories of institutions used GRSG funds in this way. Research project grants are used also for salary support, but GRSG salary support can be provided when research project funds cannot be used; for example, when investigators move from one institution to another and otherwise would have their research interrupted or when there is a hiatus in the project support of an investigator while awaiting funding of an approved new or renewal research project application. Support for central resources, such as medical arts service, glass or metal shops for general or specialized research equipment, animal resources, tissue culture research and service laboratories, is also an important means by which GRSG awards contribute to this sub-objective.

The third sub-objective is "to enable an institution to balance its program." Project and program grants are a major source of support for the accomplishment of specific goals. The administrators of grantee institutions, charged with the overall development of the institution, cannot use research project funds to initiate research that would balance institutional programs because such grants are awarded for specific projects. While GRSG funds are small compared to the total budgets involved in balancing activities, they are an important addition for a number of activities where no other funds are available. The evidence indicates that GRSG funds are used selectively to balance a number of activities.

The fourth sub-objective is "to enhance the institution's role and initiative in determining the direction of its programs." In the data and information sources used for the Roth-Boynton study, flexibility, immediacy, and local control are among the strongest attributes of the GRSG program.

The fifth sub-objective is "to meet emerging opportunities in research via support of the pursuit of unorthodox ideas." Data in the Roth-Boynton study show clearly that the GRSG program complemented the research project system by providing funds for unanticipated costs of some projects and by supporting small and pilot projects far out of proportion to its size among all sources of support available for research.

The sixth sub-objective is "to enable earlier recognition and support of scientific talent." The Roth-Boynton study concluded that the GRSG program "has an unusual role to play in the early recognition of scientific talent." Its importance lies in the large number of health professional students who receive stipend and research support each year, and in its use for integration of the research training into the ongoing program of the institution.

The seventh sub-objective is "to provide incentive to attract more nonfederal funds." The eighth sub-objective is "to add rather than supplant other support." The Roth-Boynton study shows that GRSG-supported activities attract both Federal and nonfederal research support indicating that the sub-objectives are being achieved.

The above summarization indicates that the GRSG program is accomplishing its objectives, that the GRSG program is distinctive when compared to the research project grant system, and that GRSG complements the project system whether or not the GRSG features are distinctive or share a commonality with the project system.

The Relative Importance of the Several GRSG Objectives in "Growth" Versus "Maintenance" Situations

A review of the recent evaluation study indicates the value of the GRSG program (1) to health institutions, (2) to the NIH in terms of the viability of institutions wherein the NIH can and does achieve its disease-oriented missions, and (3) to the health of the Nation. Such a review also reveals that certain of the program goals are more important in

situations where research project grant support has leveled off or is decreasing than in situations in which it is increasing.

A major impact of the GRSG program is the creation of new institutional research entities (programs, departments, central resources, etc.). The vigor and effectiveness of biomedical research at an institution, even with a steady level of effort, depend upon the creation of some new entities to readjust priorities, to maintain program quality, and to insure maximum productivity. Other GRSG goals and accomplishments also continue to be of vital importance when the level of effort is not changing. The problem of providing initial support for young and new investigators just beginning research and teaching careers is especially difficult when there is a shortage of research project funds. GRS funds are often the only ones available for this purpose. If this type of support is not forthcoming at this critical period of career development, serious consequences in terms of replenishment of the research manpower pool will result.

THE DISTRIBUTION OF GENERAL RESEARCH SUPPORT FUNDS BY FORMULA

This section is concerned with a question posed in the introduction, Does the distribution of general research support by the existing formulae result in the concentration of such support in a limited number of first-rate research institutions rather than to help develop new or weak research institutions?

General Research Support Grants are made annually for the calendar year January 1 through December 31. Biomedical Sciences Support Grants are for the period June 1 through May 31. GRSG and BSSG awards to fully funded grantees are computed on the basis of the total amount of allowable research project grants awarded by the NIH and NIMH for support of research of the applicant institution during the latest completed 12-month period, July 1 through June 30, inclusive.

The Formulae

Each applicant for either a GRSG or BSSG must provide annually a list of its allowable NIH and NIMH research project grants. A minimum of $100,000 in such grants in the case of GRSG applicants and $200,000 in the case of BSSG applicants is required before applications will be accepted for further review. In addition, the NIH staff and advisory groups consider the degree of diversity, complexity, and breadth of the institution's total biomedical research and research training activities, including those

supported from sources other than NIH and NIMH. In establishing eligibility for General Research Support and the amount of entitlement used to compute an award (formulae are given on page 112), the NIH reserves the right to determine the acceptability of any grant listed in the application.

The sum of the amounts produced by application of each formula is increased or decreased by whatever uniform factor is required to prorate awards to match available funds.

Since the 1968 revision of the GRSG program, any GRSG or BSSG grantee that did not maintain the minimal criterion of $100,000 or $200,000, respectively, in allowable NIH and NIMH research project grants has received phase out support at a reduced level.

A comparison of the formulae used for the allocation of funds to the GRSG and BSSG grantees discloses three areas in which they differ significantly: (1) the threshold for eligibility for a BSSG is twice the amount in NIH and NIMH research project grants as for the GRSG; (2) the formula yield, prior to prorating awards to match available funds, is greater in the case of the GRSG up to $6.0 million of entitlement; and (3) while there is no upper limit on the amount of project grant funds on which credit is allowed by the BSSG formula, there is a limit to $6.0 million in the case of the GRSG formula. One effect of these differences, and of differences in the frequency distributions of entitlement amounts and in the amounts of funds available for distribution in the two formula programs, is seen in the ratios of the total amount of formula awards to the amount of allowable

NIH-NIMH research project grants presented by all grantees. For GRSG, this ratio is 10.7 percent; for BSSG, 5.8 percent.

For 1970, 92 percent of the total amount of NIH-NIMH research project grants allowable for entitlement credit under the GRSG and BSSG programs was awarded to institutions that participate in these two formula award programs.

Analysis of the Formula Distribution of General Research Support Funds

In order to measure the impact of distributing GRSG and BSSG funds by formula, the experience of the programs in FY 1970 was examined.

Tables 31 and 32 show the composition of the community of grantees for the two formula programs. The BSSG grantees as a class are more homogeneous than the GRSG grantees, because the former consists only of non-health professional components of academic institutions. It is seen that about three times as many GRSG's were awarded as BSSG's. Awards under both programs were made to 249 private and 208 public institutions. With the exception of the schools of medicine, most of the grantees in both programs present entitlements of less than $2.0 million. In the case of the GRSG program, 81 percent of the grantees fell within this group and 84 percent in the case of the BSSG program. Table 33 shows on a cumulative basis the number and percentage of awardees in each entitlement category. The distribution of the schools of medicine, with respect to the several entitlement categories in Table 32 reflects the relatively heavy investment of NIH-NIMH research funds in those schools, and Table 34 shows the actual distribution of funds which resulted from the application of the formulae.

TABLE 31

GENERAL RESEARCH SUPPORT PROGRAM
NUMBERS OF AWARDS BY INSTITUTIONAL TYPE - FY 1970

	Number	Percent	Public	Private
General Research Support Grants				
Schools of Medicine	100	29.1	55(1)	45
Schools of Dentistry	49	14.2	24(7)	25(11)
Schools of Osteopathy	5	1.4	-	5
Schools of Pharmacy	15	4.4	13	2
Schools of Veterinary Medicine	17	4.9	14	3
Schools of Public Health	12	3.5	6(1)	6
Hospitals	79	23.0	12	67(7)
Health Departments	3	.9	3	-
Other Research Institutions	64	18.6	13(1)	51(2)
TOTAL	344	100.0	140(10)	204(20)
Biomedical Sciences Support Grants				
TOTAL	113	100.0	68(5)	45(3)

( ) = Included number of phase-out awards made because threshold requirements have not been met.

TABLE 32

GENERAL RESEARCH SUPPORT PROGRAM
NUMBERS OF AWARDS BY INSTITUTIONAL TYPES AND ENTITLEMENTS[1/] FY 1970

			Entitlement in Thousands of Dollars																				
	No.	%	0-499	500-999	1000-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	4000-4499	4500-4999	5000-5499	5500-5999	6000-6499	6500-6999	7000-7499	7500-7999	8000-8499	8500-8999	9000-9499	9500-9999	10000-10499
General Research Support Grants			NUMBERS OF AWARDS																				
Schools of Medicine	100	29.1	12(1)	14	11	10	8	10	8	3	1	2	2	1	2	1	-	1	5	1	3	3	2
Schools of Dentistry	49	14.2	41(18)	6	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schools of Osteopathy	5	1.4	5(5)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schools of Pharmacy	15	4.4	14	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schools of Veterinary Medicine	17	4.9	13	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Schools of Public Health	12	3.5	6(1)	3	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hospitals	79	23.0	48(7)	14	8	2	2	2	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
Health Departments	3	.9	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Research	64	18.6	40(3)	8	11	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	344	100.0																					
Biomedical Sciences Support Grants																							
TOTAL	113	-	43(8)	28	18	6	7	2	4	-	3	-	-	-	1	-	1	-	-	-	-	-	-

1/ Entitlement = Dollar amounts of relevant NIH-NIMH research grants received in preceding fiscal year.
( ) = Included number of phase-out awards made because threshold requirements have not been met.

TABLE 33

GENERAL RESEARCH SUPPORT PROGRAM
NUMBER OF AWARDS BY GRANT TYPE AND ENTITLEMENT[1/] - FY 1970
(Cumulative Number and Percent Within Grant Type By Increasing Entitlement)
(Dollar Amount in Thousands)

Type of Grants	Entitlement															
	$0-$199		$0-$499		$0-$999		$0-$1999		$0-$2999		$0-$3999		$0-$4999		$0-$5999		$0-Maximum	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
General Research Support Grants	86	25%	181	53%	231	67%	279	81%	305	89%	317	92%	322	94%	325	94%	344	100%
Biomedical Sciences Support Grants	8	7%	43	38%	71	63%	95	84%	104	92%	108	96%	111	98%	111	98%	113	100%
Total Both Types of Grants	94	21%	224	49%	302	66%	374	82%	409	89%	425	93%	433	95%	436	95%	457	100%

1/ Entitlement = Dollar amounts of relevant NIH-NIMH research grants received in preceding fiscal year.

TABLE 34

GENERAL RESEARCH SUPPORT PROGRAM
FY 1970 AWARDS BY INSTITUTIONAL TYPE AND ENTITLEMENT [1]
(Dollar Amounts in Thousands)

	Institutions		Entitlement										
	No.	Percent	$0-199	$200-499	$500-999	$1000-1999	$200-2999	$3000-3999	$4000-4999	$5000-5999	$6,000 & Up	Totals	Percent
General Research Support Grants			A W A R D S										
Schools of Medicine	100	29.1%	$ 90	$ 786	$1,824	$4,318	$4,816	$3,298	$1,026	$1,066	$7,081	$24,306	53.0%
Schools of Dentistry	49	14.2	500	982	668	371	-	-	-	-	-	2,521	5.5
Schools of Osteopathy	5	1.4	44	-	-	-	-	-	-	-	-	44	0.1
Schools of Pharmacy	15	4.4	263	336	119	-	-	-	-	-	-	718	1.6
Schools of Veterinary Medicine	17	4.9	381	638	362	186	-	-	-	-	-	1,566	3.4
Schools of Public Health	12	3.5	12	472	360	211	519	-	-	-	-	1,573	3.4
Hospitals	79	23.0	880	1,464	1,760	1,951	997	-	672	-	395	8,119	17.7
Health Departments	3	.9	-	198	154	-	-	-	-	-	-	351	0.7
Other Research Institutions	64	18.6	332	1,978	1,029	2,462	521	281	-	-	-	6,603	14.4
Total	344	100.0%	$2,502[2]	$6,854	$6,276	$9,499	$6,853	$3,579	$1,698	$1,066	$7,476	$45,802	99.8%
Percent of GRSG Awards			5.5%	15.0%	13.7%	20.7%	15.0%	7.8%	3.7%	2.3%	16.3%	100.0%	
Yield[4]			.28	.22	.18	.14	.11	.09	.08	.07	.07		
Biomedical Sciences Support Grants													
Total	113	100.0%	$ 138[3]	$1,369	$1,678	$1,836	$ 868	$ 451	$ 410	-	$ 376	$ 7,126	
Percent of BSSG Awards			1.9%	19.2%	23.5%	25.8%	12.2%	6.3%	5.8%	-	5.3%	100.0%	
Yield[4]			.11	.13	.08	.06	.04	.04	.03	-	.03		

1/ Entitlement = Dollar amounts of relevant NIH-NIMH research grants received in preceding fiscal year.
2/ This figure includes awards to institutions being phased-out due to failure to meet threshold requirements for FY 1970.
3/ This figure represents awards to institutions being phased-out due to failure to meet threshold requirements for FY 1970.
4/ Yield = Award/Entitlement.

In the GRSG program two-thirds of the funds are distributed to the schools of the health professions. Formula program awards, as a percentage of entitlement, are greatest at the lowest level of entitlement. For the GRSG program this percentage (yield) decreases to approximately one-fifth of this maximum at the highest level of entitlement (Table 34). The BSSG formula yields 13 percent in the lowest regularly eligible category of entitlement shown in Table 34 with a decrease to 3 percent in the highest category. Thus, the formulas tend to favor the smaller grantees in terms of the award to entitlement ratio.

In terms of absolute amounts of funds awarded, 54 percent of the GRSG funds were granted to those institutions whose entitlement fell below $2.0 million, with 70.4 percent of the BSSG funds being awarded in the same entitlement categories. With respect to the several categories of awardees in the GRSG program, it is seen that the schools of medicine, which make up 29.1 percent of the grantees, receive 53.0 percent of the funds of the program. This reflects the high levels of entitlement claimed by medical schools (70 percent of entitlement claims by all GRSG grantees). Table 35 shows on a cumulative basis the distribution of awarded funds across the several entitlement class intervals.

Table 36 shows the relatively low yield (award to entitlement ratio) garnered by schools of medicine (8 percent) as compared to the other categories of GRSG grantees (14-21 percent). This, in turn, is a reflection of the relatively high average entitlement of the schools of medicine.

TABLE 35

GENERAL RESEARCH SUPPORT PROGRAM
FY 1970 AWARDS BY GRANT TYPE AND ENTITLEMENT[1/]
(Cumulative Amount and Percent Within Grant Type by Increasing Entitlement)
(Dollar Amounts in Thousands)

	Entitlement																	
	$0-$199		$0-$499		$0-$999		$0-$1999		$0-$2999		$0-$3999		$0-$4999		$0-$5999		$0-Maximum	
Type of Grants	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
General Research Support Grants	$2,502	6%	$ 9,356	20%	$15,632	34%	$25,131	55%	$31,984	70%	$35,563	78%	$37,261	81%	$38,327	84%	$45,803	100%
Biomedical Sciences Support Grants	138	2%	1,507	21%	3,185	45%	5,021	70%	5,889	83%	6,340	89%	6,750	95%	6,750	95%	7,126	100%
Total Both Types of Grants	$2,640	5%	$10,863	21%	$18,817	36%	$30,152	57%	$37,873	72%	$41,903	79%	$44,011	83%	$45,077	85%	$52,929	100%

1/ Entitlement = Dollar amount of relevant NIH-NIMH research grants received in preceding fiscal year.

TABLE 36

GENERAL RESEARCH SUPPORT PROGRAM
FY 1970 AWARDS AND ENTITLEMENTS[1] BY FULL AWARD AND PHASE-OUT CATEGORIES, AND BY INSTITUTIONAL TYPE
(Dollars Amounts in Thousands)

	Number	Percent	Total Awards		No. of Awards		Average Award		Total Entitlement		Yield[2]	
			Full	Phase-Out	Full	Phase-Out	Full	Phase-Out	Full	Phase-Out	Full	Phase-Out
General Research Support Grants												
Schools of Medicine	100	29.1	$24,280	$ 26	99	1	$245	$26	$312,897	$ 55	.08	.47
Schools of Dentistry	49	14.2	2,332	189	31	18	75	11	13,126	421	.18	.45
Schools of Osteopathy	5	1.4	-	44	-	5	-	9	-	91	-	.48
Schools of Pharmacy	15	4.4	718	-	15	-	48	-	3,453	-	.21	-
Schools of Veterinary Medicine	17	4.9	1,566	-	17	-	92	-	6,523	-	.24	-
Schools of Public Health	12	3.5	1,561	12	11	1	142	12	9,717	-	.16	-
Hospitals	79	23.0	7,992	127	72	7	111	18	57,572	509	.14	.25
Health Departments	3	0.9	351	-	3	-	117	-	1,701	-	.21	-
Other Research Institutions	64	18.6	6,534	68	61	3	107	23	41,858	156	.16	.44
TOTAL	344	100.0	$45,334	$466	309	35	$147	$13	$446,847	$1,232	.10	.38
Biomedical Sciences Support Grants												
TOTAL	113	-	$ 6,987	$138	105	8	$ 67	$17	$121,916	$1,235	.06	.11

1/ Entitlement = Dollar amount of relevant NIH-NIMH research grants received in preceding fiscal year.
2/ Yield = Award/Entitlement.

In FY 1970 GRSG awards to private institutions ($26.5 million) exceeded those to public institutions ($19.2 million). In the BSSG program $2.9 million went to private institutions, while $4.2 million went to public institutions. The average GRSG award to private institutions is $132,685; to public institutions, $137,343. The average BSSG award to private institutions is $65,444; to public institutions, $61,471 (Tables 31 and 37).

Table 38 compares the experience of medical schools founded prior to 1940 with that of those founded since that time, segregated by half-decade of founding, in terms of attracting GRSG funds. It appears that the eleven schools founded since 1965 as a class do quite well indeed, accounting for 7.1 percent of the total funds awarded to schools of medicine. One of those eleven schools has an entitlement of more than $6.0 million but that medical school was established in a hospital with an extensive research program. Furthermore, neither the entitlement nor the award for that medical school introduces any significant distortion of the data. Those institutions founded between 1940 and 1954 attract average awards greater than those founded prior to 1940. Considering the time required to attract and stabilize a faculty and to attract research project support, it would appear that the formula permits new and developing institutions to compete for GRSG funds without disadvantage.

Examination of the data contained in Tables 31 through 35 leads to the conclusion that questions such as "Do the funds tend to go to a limited number of first rate research institutions rather than to help develop new

TABLE 37

GENERAL RESEARCH SUPPORT PROGRAM
FY 1970 AWARDS BY FULL AWARD AND PHASE-OUT CATEGORIES AND BY TYPE AND STATUS OF INSTITUTION
(Dollar Amounts in Thousands)

	Public				Private				Public and Private			
	Full Awards	Phase-Out	Total	Percent	Full Awards	Phase-Out	Total	Percent	Full Awards	Phase-Out	Total	Percent
General Research Support Grants												
Schools of Medicine	$12,118	$ 26	$12,144	62.4%	$12,162	-	$12,162	46.1%	$24,280	$ 26	$24,306	53.1%
Schools of Dentistry	1,426	84	1,510	7.8%	906	$105	1,011	3.8%	2,332	189	2,521	5.5%
Schools of Osteopathy	-	-	-	-	-	44	44	.2%	-	44	44	.1%
Schools of Pharmacy	637	-	637	3.3%	81	-	81	.3%	718	-	718	1.6%
Schools of Veterinary Medicine	1,242	-	1,242	6.4%	324	-	324	1.2%	1,566	-	1,566	3.4%
Schools of Public Health	616	12	628	3.2%	946	-	946	3.6%	1,562	12	1,574	3.4%
Hospitals	1,808	-	1,808	9.3%	6,184	127	6,311	23.9%	7,992	127	8,119	17.7%
Health Departments	351	-	351	1.8%	-	-	-	-	351	-	351	.8%
Other Research Institutions	1,103	25	1,128	5.8%	5,432	43	5,475	20.8%	6,535	68	6,603	14.4%
TOTAL	$19,301	$147	$19,448	100.0%	$26,035	$319	$26,354	99.9%	$45,336	$466	$45,802	100.0%
Biomedical Sciences Support Grants												
TOTAL	$ 4,091	$ 89	$ 4,180	-	$ 2,896	$ 49	$ 2,945	-	$ 6,987	$138	$ 7,125	-

TABLE 38

GENERAL RESEARCH SUPPORT PROGRAM
NUMBER OF MEDICAL SCHOOLS RECEIVING FY 1970 GENERAL RESEARCH SUPPORT GRANTS
BY AGE OF SCHOOL AND ENTITLEMENT 1/
(Dollar Amounts in Thousands)

Year of Founding	Entitlement: $0-199	$200-499	$500-999	$1000-1999	$2000-2999	$3000-3999	$4000-4999	$5000-5999	$6000 & Up	No.	Total Awards	% Total Award Amount	Average Award	Average Entitlement	Average Yield 2/
	Number of Awards														
1965-1969	1	1	6	2	-	-	-	-	1	11	$ 1,541	6.3%	$140	$ 1,312	.11
1960-1964	-	1	1	1	-	-	-	-	-	3	352	1.4%	117	728	.16
1955-1959	-	1	-	-	1	-	-	-	1	3	769	3.2%	256	5,017	.05
1950-1954	-	-	-	1	-	-	1	-	1	3	934	3.8%	311	15,360	.02
1945-1949	-	-	1	-	-	-	-	-	1	2	515	2.1%	258	9,845	.03
1940-1944	-	-	-	-	-	1	-	-	-	1	295	1.2%	295	3,275	.09
Pre-1940	2	6	6	17	17	10	2	3	14	77	19,899	81.9%	258	3,327	.08
Total Number	3	9	14	21	18	11	3	3	18	100					
Total Awards	$ 90	$786	$1,824	$4,318	$4,816	$3,298	$1,026	$1,066	$7,081		$24,305				
Percent Total Award Amount	.4%	3.2%	7.5%	17.8%	19.8%	13.6%	4.2%	4.4%	29.1%			100.0%			
Average Award	$ 30	$ 87	$ 130	$ 206	$ 268	$ 300	$ 342	$ 355	$ 393						
Average Entitlement	$123	$383	$ 767	$1,504	$2,436	$3,443	$4,618	$5,400	$8,613						
Average Yield	.24	.23	.17	.14	.11	.09	.07	.07	.05						

1/ Entitlement = Dollar amount of relevant NIH-NIMH research grants received in preceding fiscal year.
2/ Average Yield = Average Award/Average Entitlement.

or weak research institutions?" cannot be answered simply. An institution must present evidence of some minimal level of engagement in health research in order to gain eligibility by exceeding the threshold of $100,000 of NIH-NIMH research project grants in the case of the GRSG program and $200,000 in the case of the BSSG program. This represents an average of 2 or 3 such grants to attain the GRSG threshold and 4 or 5 grants to attain the BSSG threshold. If we take as a definition of "weak or developing institutions" those institutions which meet merely minimal eligibility requirements of the program and for "first rate research institutions" those which have entitlements of several million dollars, then general research support is awarded to both types of institutions. However, as stated previously, new or weak institutions are awarded a higher percentage of their entitlement amounts than are the first rate institutions, while the latter receive the largest awards.

THE QUALITY OF RESEARCH SUPPORTED UNDER THE GENERAL RESEARCH SUPPORT PROGRAM COMPARED TO THAT SUPPORTED UNDER THE PROJECT GRANT MECHANISM

Discussion of the term "quality" in the light of the rationale for the GRSG Program

This section will attempt to demonstrate the protean nature of the term "quality" when used as a parameter to evaluate a support mechanism which by intent and design encourages support of activities that may differ from what is usually supported under the "quality" concepts of NIH research project support programs. For example, decisions to support untried and unorthodox ideas, to recognize and nurture what seemingly is talent at the earliest opportunity, to upgrade specific and critical needs for the overall betterment of an institution are decisions that are expected to lead to "quality" consequences. Thus, a grant program which provides to each grantee the authority to allocate grant funds, free from Federal intervention except in the broadest context, and for the support of numerous research activities having high local priorities and wide institutional ramifications, reflects the quality of each grantee's evaluation of its priorities at the time the grant expenditures are made.

A direct comparison of the quality of research support by project grants and that supported by the general research support mechanism is probably not possible because general research support is used, inter alia, to assist projects supported by the project grant mechanism by means such as improvements in facilities, central or shared resources, salary support,

and supplemental support for supplies, equipment, and other needs that develop during the course of investigation. Moreover, the projects supported principally by general research support funds are largely pilot projects and those supported by project grants are rarely pilot projects. In comparing pilot projects with research projects that are not pilot studies, it must be recognized that pilot projects carry the higher degree of risk. Nevertheless, pilot projects constitute an essential step without which important areas of investigation would not emerge and develop to a stage for which project grant support is suitable.

Research supported by NIH project grants enjoys a reputation for high quality. Evidence presented below is supportive of the view that research conducted under GRSG auspices is also characterized by high quality. Under each mechanism research is supported on the basis of the promise of meaningful results. When there are differences in the degree of risk involved, the quality of the risk remains as a determinant of support. Quality judgments for the GRS programs are the responsibility of committees established by the grantee institutions to plan and to review the allocation of GRS funds. National committees review and advise on applications for Federal support of biomedical research projects. The qualities of the activities supported by the two mechanisms converge when general research support is employed to establish or strengthen institutional resources used in the conduct of project grant supported research. In summary, there are many quality control mechanisms operative both at the local and national levels which assure that quality is a prime consideration in the allocation of funds under the GRS programs.

Examination of certain activities supported by the GRSG program demonstrates the value of the program both in terms of the quality of its products and in its supportive role for other quality programs such as the research project grant system.

1. Pilot Projects and Interim Support of Research

The reasons for initiating pilot projects are varied; to establish or clarify hypotheses, to explore an idea prior to intensive investigation or development, to determine the feasibility of a particular approach to a research problem before support is committed and definitive experiments begun, etc.

GRSG support is particularly suited to pilot research because such studies are frequently of short duration and low cost. Consequently, it would be preferable not to incur the expenditure of time and money that would be necessary to process pilot research proposals through the national project review system.

As seen in major findings six, seven, and eight of the Roth-Boynton study described above on pages 34 and 39, the impact of GRSG funding of pilot and other projects is significant. A reliable measure of the quality and effectiveness of projects supported by GRSG awards is the degree to which such projects lead to research proposals that succeed in receiving competitive support from other sources such as project grants.

Table 39 lists the present sources and amounts of funds for research projects that were initially funded under GRSG auspices. These data, taken from FY 1969 Annual Narrative Reports from the grantee institutions, clearly demonstrate that GRSG-supported projects are of such quality that a spectrum of NIH Institutes, other Federal agencies, and other nonfederal organizations and individuals have an interest in continuing the research work. Since the NIH research project grant system is characterized by high quality projects, the fact that sixty percent of the total support committed to projects originally supported by GRSG funds is NIH project support, indicates that high quality is also a characteristic of GRSG supported projects.

2. Peer Review

As shown earlier, a committee of peers is the major mechanism for establishing and implementing GRSG policies of the grantee institutions. Although GRSG Program Directors include health research scientists, science administrators, deans, department heads, or other faculty and staff members, at least 43.6 percent of the 1970 Program Directors are, or have been, members of the PHS or NIH public advisory groups (Table 40). Although similar figures are unavailable for all members of institutional GRSG committees, it is likely that many such members also have experience as members of PHS or NIH public advisory groups.

TABLE 39

AMOUNTS AND SOURCES OF RESEARCH SUPPORT GENERATED BY GRSG-SUPPORTED ACTIVITIES[1/]

Present Source of Funding	Level of Support For One Year	Total Support Committed For Duration of Projects
National Institutes of Health	$13,172,908	$36,373,491
Public Health Service (RM, HEW, DH, OE, CC, HSMHA, EC, AP)	1,084,609	3,773,251
Other Federal (CB, VA, Army, NSF, AEC, WHO, AID, NASA, USDA, ONR)	3,958,600	4,659,249
State, County, City	569,824	755,434
Industry	1,233,052	1,119,192
Foundations	4,582,162	7,104,773
Voluntary Health Agencies	2,004,089	3,499,478
Individuals	1,886,816	1,914,616
Professional Associations	43,760	68,160
University Funds (Faculty Grant)	64,984	90,199
Sources Not Identified	1,245,942[2/]	1,247,870[2/]
TOTAL	$29,846,746	$60,605,713

1/ Derived from 318 GRSG Annual Narrative Progress Reports for 1969. Funds generated but dollar amounts not given - 31 citations. Research grant applications approved but unfunded - 71 applications.

2/ Does not include examples such as the following: In 1968 the University of Puerto Rico School of Medicine states, "In a way, the research activities stimulated since 1962 in our School by the GRSG have helped to create a favorable image of the School in the field of health sciences before our own Government and have permitted us to justify to them the necessity of providing funds for the construction of . . . a very much needed new Medical Sciences Building ($14.3 million from University of Puerto Rico funds and $7.1 million from Federal and other external funds)." The 1969 report states that they plan to move into the new premises by January 1972.

TABLE 40

GRSG PROGRAM DIRECTORS, FY 1970,
WHO ARE OR HAVE BEEN MEMBERS
OF THE PHS OR NIH PUBLIC ADVISORY GROUPS -
1962 THROUGH 1970*

No. of Grantees FY 1970	Program Directors on PHS or NIH Public Advisory Groups	
	No.	Percent
344	150	43.6%

* Sources:
Notice of Grant Awarded.
NIH and PHS Public Advisory Group Directories.

3. Quality of Institutions Supported

Those institutions doing the most research recommended by the NIH-NIMH peer review system (high quality research) are the institutions which receive the largest amounts of GRSG funds. In addition, institutional quality of GRSG grantees is assured by the requirement that a certain threshold of selected quality research projects (excluding, for example, contracts, demonstration grants, and research training projects) be placed in evidence annually before a GRSG is awarded. The major share of GRSG sponsored research (58 percent in 1966-67) is done in medical schools--at the same institutions which perform the majority of the research under the NIH project grant system. For example, in 1966-67, 65 percent of the research project dollars derived from all sources was spent by

90 medical schools, which spent more for research than did the other 203 GRSG grantees combined (Table 41). Of course, institutional quality is not limited to the medical schools, however large that input may be.

4. Quality of Activities Supported

The following narrative examples of work supported either by the GRSG or BSSG program illustrate the type of activities judged by grantee institutions to be important in their programs. Their quality can be evaluated in terms of their effectiveness in meeting needs which indirectly benefit the institutional base of the project system -- a goal in which the NIH has a major interest.

a. Provided for an interdisciplinary approach to a research problem

Much is presently known about the structure of joints and about nature's mechanism of lubrication. Studying wear in normal and arthritic joints, and devising ways of counteracting a breakdown in the natural lubrication process, has immediate clinical significance. Such studies, however, involve types of mechanical analysis and destructive testing which lie quite outside the normal scope of medical or biological research. For such experimentation it is logical for the physician or biologist to turn to the engineer. Because of support available under the BSSG at Massachusetts Institute of Technology, it was possible for a biomechanics engineering team, jointed headed by Professor Igor Paul of the Department of Mechanical Engineering

TABLE 41

COMPARISON OF RESEARCH EXPENDITURES FROM GRSG AND FROM ALL SOURCES, 1966-67
(Dollar Amounts in Thousands)

	Medical Schools		Dental Schools		Other Schools		Hospitals		Other Research Institutions		Totals	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
All Sources	$440,856	65	$15,989	2	$48,854	7	$96,799	14	$79,770	12	$682,268	100
GRSG	22,946	58	2,283	6	3,531	9	5,959	15	4,864	12	39,583	100

at MIT and Dr. Eric L. Radin at the Orthopedic Research Laboratories of the Massachusetts General Hospital, to be created specifically to work on this problem.

The apparatus developed for this research was christened an arthrotripsometer. With its meticulously engineered interplaying array of gears, bearings, and shafts, linked by transducers to sophisticated electronic measuring and recording equipment, the instrument is imposing enough to live up to its 6-syllable name. Yet, its basic idea is hardly more complicated than that underlying the contrivances devised for consumer testing of shoe wear. Instead of mechanically marching a shoe on a journey without destination, the upper and lower portions of a bovine ankle joint are mounted, carefully aligned, and set in a "walking" motion with an oscillating load. The sensitive accessory equipment functions to give accurate measurements of the wear and deformation in the joint under different loads, different speeds of oscillation with different types of lubricating fluid, and under different initial conditions in the joint itself. Wear in the normal joint, for example, is compared with the type of wear experienced by an arthritic joint. Also, nature's synovial fluid is compared with buffers as a lubricating fluid. The preliminary results have been most encouraging, both in the areas of an understanding of joint function and in the prevention of cartilage wear. It is hoped that these findings will soon be of use in the clinical treatment and prevention of degenerative arthritis.

There are innumerable avenues, many of them already clearly evident and conceptually mapped out, in which collaboration between the engineering and medical professions could transcend existing barriers to research progress. Yet, everyday circumstances, particularly with regard to support, consistently militate against exploring such possibilities. The BSSG, in its brief term of three years thus far at MIT, has provided the most important means of enabling engineers to cross institutional boundaries to work in active collaboration with their medical colleagues.

b. Contributed significantly to the development of a new medical school

At the University of New Mexico School of Medicine, the impact of the GRSG was significant throughout the entire program of this developing school of medicine. The flexible and discretionary quality of the funds was of immeasurable value in permitting response to the multiple, diverse, and unanticipated needs which arise during the course of developing a new school.

This flexibility is demonstrated concisely by the collaborative efforts of Drs. Scaletti, LeBaron, and Napolitano in the Departments of Microbiology, Biochemistry, and Anatomy, respectively.

In the early development of the Medical School, these investigators were without equipment and technical assistance, and they had only limited funds with which to initiate research. All three investigators had common interests in the biology of human

cell membranes. Dr. Scaletti, a microbiologist, was interested in the changes in membranes of cells infected with animal-tumor-producing viruses. Dr. LeBaron, a biochemist, was interested in the fate of proteins in the membranes of nerve tissue, particularly in demyelinating diseases (such as multiple sclerosis in which membrane structures become unstable). Dr. Napolitano, an anatomist, was interested in the ultrastructureal changes in membranes resulting from diseases of the nervous system.

These investigators now have their own project grants individually and collaboratively and are continuing their interdisciplinary cooperative research effort. Drs. Scaletti, LeBaron, and Napolitano contribute to the integrated teaching program for the first and second year medical students. As a result of their integrated research efforts, these faculty members integrate the teaching of the cell, cell structure, chemistry and cell function in that part of the program designated Principals of Biomedical Sciences. In addition, medical students have elected to work in the research laboratories of these investigators and have gained experience and training in studies of the membranes of cells.

c. Supported a pilot project on the illicit use of drugs

The Bureau of Research and Neurology and Psychiatry, New Jersey, undertook a pilot project on the illicit use of hallucinogenic drugs. The three studies undertaken were: (1) the use of marijuana

at a nearby college, (2) a study of the use of LSD by heroin addicts, and (3) a pilot study of LSD-using groups. The study, which is now also being supported by the NIMH, has already produced evidence of the value of making sociological investigations into the nature and meaning of illicit drug use. The investigators became concerned with the actual chemical analyses of the drugs being taken. Analysis showed that though several of the samples were alleged to be mescaline or psylocybin, in fact they were neither. Most were LSD-25, but two alleged mescaline samples were STP (5-dimethoxy-4-methyl-amphetamine).

Sociologists recognized at once the significance of these findings because their studies had given them a clear perception of the social meaning of these drugs. This deception on the part of the felonious chemists requires wide publicity since it would probably act as a deterrent to the illicit users of strong psychedelics. From their knowledge of the group, the sociologists have evidence that experienced users are much more likely to take mescaline or psylocybin because of their fears of LSD-25 following the chromosome damage scare, while the majority of infrequent and even very experienced users regard STP with such apprehension that they would be very unlikely to take it. If the knowledge that STP was being sold as mescaline became published widely, this would undermine the confidence of both potential and experienced users in the quality of the illicit drugs being sold.

Thus, sociological research into psychedelic drug use makes possible the gathering and interpretation of information which is likely to check the usage of these drugs and reduce the damage inflicted by them. Arrangements are being made with the NIMH, the Justice Department, and the State of New Jersey to make these findings available to the public.

d. Complemented ongoing NIH or NIMH research resource grant or research project grant

(1) Emory University School of Medicine found it necessary to seek a new leader for its NIH supported General Clinical Research Center. While the Clinical Center grant provided most of the salary for its director, it did not provide for some aspects of his basic research program. The School of Medicine agreed to use GRSG funds to supplement the development of a laboratory for the Center and to provide temporary support of several Center investigators. A director was recruited and a new research team immediately began seeking their own individual support. That the GRSG helped to make the right move at the appropriate time is reflected in the fact that the Center was not included as one of those which recently were scheduled for phasing out.

(2) At the Cleveland Psychiatric Institute, a 5-year investigation funded by NIMH was recently renewed for an additional two years. Patients are being evaluated to study

differences in patient characteristics, the effects of hospital-treatment variables, and the impact of various features of the extramural milieu upon these patients.

Existing staff exclusively funded by the NIMH grant were left unfunded when award delays and cutbacks occurred. Use of the GRSG for salary support was instrumental in providing continuity and in enabling the project to be completed.

e. Avoided a costly crisis in a research program of world-wide significance

At the Bio-Research Institute, Cambridge, Massachusetts, reductions in grants-in-aid support threatened the continuity of fifteen highly inbred lines of Syrian hamsters. These animals represent a new and unique animal model resource and are the result of more than ten years of systematic inbreeding and study.

By funding two senior investigators and their supporting personnel from the institution's GRSG, genetic material was preserved, balance was maintained in some of the research projects, and the following discoveries were made. These investigators reported in J.A.M.A. 212:604-610, April 27, 1970, that inbred strains of hamsters have been established which carry the hereditary diseases of muscular dystrophy, cardiomyopathy with congestive heart failure, obesity, adrenal adenomatosis, and progressive hind-leg paralysis. These conditions resemble human

disease entities for which these new animal models offer valuable, if not essential, experimental systems for their study. The hamsters have also demonstrated inherited susceptabilities to teratogenic agents (thalidomide), calcium cyclamate toxicity, and polycyclic hydrocarbon carcinogenesis.

Besides support provided by the GRSG, these investigations at the Bio-Research Institute were supported in part by the NICHD (HD-00769), the NIAMD (AM-06190), NHI (HE-09791), the NCI (CA-10101), The John A. Hartford Foundation, and by contract (63-67) from the Food and Drug Administration.

f. Attracted full-time faculty at a medical school

The Loyola University Stritch School of Medicine specifically committed GRSG funds for the recruitment of high-quality faculty and for pilot experiments required to attract appropriate outside financing of research in pediatrics. During the short period of one year, fully one-half of the completely new, full-time faculty of the Department of Pediatrics was given modest but effective assistance. Thus, from a purely volunteer operation, a full-time nucleus of eight scientist-physicians was attracted and established in a department which now provides very well for teaching, research, and patient care responsibilities of a fully functional academic department.

g. Fostered interuniversity collaboration

At Florida State University an outstanding new effort has been initiated during the past year with the help of BSSG funds.

Dr. William A. H. Rushton has joined the faculty and is in the process of establishing a research group investigating visual--particularly retinal--processes. The establishment of the research group is the result of a joint effort between Florida State University and the Psychobiology Research Center in Cambridge University, England, where Dr. Rushton still maintains a part-time appointment and where he has served as professor of visual physiology for the past two years.

Working with Dr. Rushton for the first year were: Dr. Shuki Torii of the California Institute of Technology, Dr. Matt Alpern from the University of Michigan Medical School, and Dr. Ann Fulton (an ophthalmological specialist) of the Florida State University Health Center. A new human visual photometer was designed and its construction was completed in the Institute of Molecular Biophysics' shop. This instrument allows stimulus-response measurements to be made over many log units of light-stimulus intensity, and is adapted for the very low-stimulus intensity range in which vision actually takes place. The most important finding of the visual research group's effort during the past year is a clear-cut demonstration that visual adaption--particularly dark adaption--is not completely dependent upon photochemical bleaching, but upon a complex neural interaction taking place with the retina.

h. Supplemented applied research at the community level

At the George Peabody College for Teachers, Nashville, a group

of workers in the Kennedy Center (Demonstration and Research Center for Early Education) and from the Division of Nutrition in the Department of Medicine at Vanderbilt University Medical Center have joined forces to study the relationship between certain aspects of nutrition and learning. Both the Kennedy Center and the Division of Nutrition have a major commitment to intervention work where research findings are applied in a controlled field setting. With the help of a small amount of money from the BSSG, a dietary study of culturally disadvantaged children has been carried out in an educational intervention program developed and operated by the Kennedy Center. Nutritional assays, and dental and general physical examinations were performed together with anthropometric measurements, determination of clinical laboratory values and evaluation of intellectual achievement, and other behavioral parameters.

i. Instrumental in formulating a better research grant application

The BSSG at Washington University, St. Louis, was used by an interdisciplinary team of investigators to initiate studies of the degradation of blood in artificial organs and extracorporeal systems. In order to design artificial internal organs and extracorporeal circuits intelligently, the biomedical engineer requires a clear understanding of the processes by which blood becomes damaged during circulation through such systems. Only when this understanding has been developed can these devices be designed on a rational basis to minimize blood trauma. It is the specific aim of the studies to

define these processes and quantitatively determine the factors in each which govern blood trauma--that is, to investigate not the detailed nature of the damage itself, but the mechanisms controlling the damage process in blood under flow conditions characteristic of present artificial organs and extracorporeal systems.

The BSSG enabled the investigators to strengthen an NIH project grant application with more detailed and sharply defined ideas, and to gain a head start in establishing the research program and maintaining a degree of momentum during the period of funding uncertainty while awaiting word of the disposition of the application.

Interpretation and Conclusion

Granted the assumption that the quality of GRSG sponsored activities is not the only measure of the program's effectiveness, and with the realization that its comparison to a program (project system) which was designed primarily to support quality projects to the exclusion of less meritorious endeavors, the above mentioned comparisons of quality indicators speak well for the GRSG program.

A fair assessment based on continuing surveillance of grantee activities by NIH staff, the judgments of the General Research Support Scientific Advisory and Review Committee and the National Advisory Health Council, the findings of the NAS-NRC and Roth-Boynton evaluation studies, and the reviews of the Roth-Boynton study by ad hoc advisory committees is that the GRSG program compares favorably with the research project grant system in the support of quality research.

THE ADVANTAGES AND DISADVANTAGES OF DISTRIBUTING RESEARCH FUNDS UNDER THE GENERAL RESEARCH SUPPORT PROGRAM WHEN HIGH QUALITY PROJECT GRANTS GO UNFUNDED

Conclusions regarding the desirability of continuing general research support when high quality project grants go unfunded should be based on (1) the value placed on the objectives of general research support, (2) the amount of general research support compared to project support, and (3) the consequences of terminating general research support.

Most observers agree that project grants should continue to provide the major Federal support for biomedical research. General research support makes it possible to achieve research objectives (see preceding sections) that benefit the investigators, their institutions, and the granting agency objectives and which are not possible with project grants or for which project grants are not well suited.

The rationale that led to the enactment in 1960 of legislative authority for general research support continues to be valid. Evaluation of general research support by the Roth-Boynton study documented the unique values of flexible institutional research support that are unattainable or unlikely of attainment through project support. In the Roth-Boynton survey questionnaire, respondents were asked to list, in rank order of importance, the major contributions of the GRSG program and the general virtues of the program that facilitate and enable the achievement of the specific program contributions. A maximum of six most important contributions and of four

most important virtues were coded for each grantee institution. Totals of the most frequently mentioned contributions, weighted by a factor of six for the contribution considered most important by the respondent, and by factors decreasing to one for the sixth most important contribution, are shown in Table 42. Frequencies of citation similarly weighted for four levels of importance are shown in Table 43 for GRSG virtues.

One reason for the importance of local determination of how GRSG funds should be used and of local authority for allocation of the funds is that time does not often permit the making of such decisions outside the institution if GRSG support is to be effective. As long as project grants continue to be the principal mechanism for research support, general research support will be important in assisting institutions to cope with unforseen interruptions in project support. This is particularly true with regard to salary support derived from project grants. General research support helps to stabilize salaries and thereby provide a measure of security that prevents the loss of highly trained and talented teachers and investigators from the staffs of educational and research institutions, including the health professional schools.

Present research capability should be preserved if previous efforts to develop it are not to be wasted and if future development of research capability is to be as rapid, effective, and economical as possible. Well-qualified investigators are the most critical resource for research. They are the resource that requires the longest time and the greatest expense

TABLE 42

TOTALS OF MOST FREQUENTLY MENTIONED GRSG CONTRIBUTIONS, WEIGHTED BY DECREASING ORDER OF IMPORTANCE, BY CLASS OF INSTITUTION

Contributions	Weighted Frequency of Citation					
	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Organizations	Totals
Support or Strengthen Research (General)	122	125	43	95	69	454
Support Pilot Projects (other than for young investigators)	119	107	53	85	53	417
Recruit New Faculty	140	32	29	42	44	287
Support Central or Shared Resources (General)	94	54	13	66	46	273
Develop New Projects	58	26	32	95	52	263
Support On-Going Research (Emergency Funds for Research)	96	31	24	50	59	260
Develop New Programs and New Areas of Research Interests	47	9	47	59	70	232
Student Research or Research Training	33	56	44	19	10	162
Stimulate Research Interest of Faculty and Staff	22	44	33	34	11	144

*Underlined figures represent the highest five numbers for each class of institution.

TABLE 43

TOTALS OF MOST FREQUENTLY MENTIONED GRSG VIRTUES, WEIGHTED BY DECREASING ORDER OF IMPORTANCE, BY CLASS OF INSTITUTION

Virtues	Medical Schools	Dental Schools	Other Schools	Hospitals	Other Research Organizations	Totals
Facilitates Growth and Development of Institution	117	30	32	56	52	287
Flexibility	70	19	9	40	18	156
Facilitates Innovation	40	26	29	17	16	128
Immediacy	32	23	5	14	11	85
Allows Planning and Implementation of Long-Range Goals	22	12	15	11	11	71
Allows Balancing (Institution, Programs, Research)	9	8	13	17	7	54
Local Control	6	0	2	4	0	12

to develop. Investigators are the resource that is most readily lost, and they are lost when their support is interrupted. The small percentage of research support that is invested in general research support has become increasingly important in maintaining continuity of support for investigators currently when interruptions in research project support are occurring with increasing frequency because of curtailments in Federal research appropriations.

General research support represented approximately 7.8 percent of NIH-NIMH research project grant funds in FY 1970. Diversion of general research support funds to project support would make it possible to fund additional approved project grant applications for the benefit of some individual principal investigators, but at the expense of investigators with research project grant support at their institutions who otherwise benefit from the important and unique features of general research support that help to hold together and strengthen the research enterprise of the institutions.

The Roth-Boynton study investigated the effects on grantee institutions of converting general research support to project support with no change in the total level of support. Respondents generated their own responses to this question and were not provided a list of possible responses from which to select those most applicable to their institutions. Responses are characterized as being either specific contributions of the GRSG program or its general virtues. Contributions cited fell into sixty-five discrete

categories, each of which is assigned a code for recording purposes. Seven categories of virtues were identified among the responses. Although virtues are distinguishable from contributions, the two are related in that the virtues are the characteristics that frequently are essential for GRSG support to make possible the contributions cited. The contributions cited by the largest number of grantee institutions as being those whose loss would affect their health research programs are shown in Table 44. The numbers of institutions citing each virtue as being one whose loss would affect their health research programs are shown in Table 45.

When respondents were asked to indicate the probable effect that shifting general research support to project grants would have by rank and type of research personnel, the replies indicated that more institutions would experience a decrease in research support for every category of investigator than would those that would expect increases. Young investigators, instructors, and assistant professors were reported by the largest numbers of grantee institutions as likely to incur such a decrease (Table 46).

Another question asked of GRSG grantees in the Roth-Boynton study was, "Would small projects decrease if a change from general research support to research project support should occur?" Ninety percent of all grantees responded that small project support would decrease; almost one-half estimated that such support would be reduced by more than 75 percent (Table 47).

TABLE 44

GRSG CONTRIBUTIONS CITED BY THE LARGEST NUMBER OF INSTITUTIONS AS THOSE WHOSE LOSS WOULD AFFECT THEIR HEALTH RESEARCH PROGRAMS

GRS Contribution	Institutions Citing as Major Effect on Research	
	Number	Percent of All Respondents
1. Seed grants and support of pilot projects conducted by other than young investigators	105	35.8
2. Support or strengthen research (general)	86	29.3
3. Students, trainees, and fellows (stipends and research)	86	29.3
4. Support central or shared resources	87	29.7
5. Recruit new faculty (staff)	73	24.9
6. Support research of new and young investigators	68	23.2
7. Support on-going research (may mention emergency funds for research)	48	16.4
8. Develop and strengthen departments	42	14.3
9. Develop new programs and new areas of research interests	40	13.7
10. Develop new projects	39	13.3
11. Support and stabilize faculty salaries	39	13.3
12. Interim salary support where specific mention is made that researcher is awaiting a grant or is between grants-emergency salary.	36	12.3

TABLE 45

INSTITUTIONS CITING EACH GRSG VIRTUE AS ONE WHOSE LOSS WOULD AFFECT THEIR HEALTH RESEARCH PROGRAMS

Virtue	Number of Institutions Citing	Percent of Institutions Responding	Percent of Institutions Citing Any Virtues
1. Flexibility	162	55.3	71.1
2. Immediacy	92	31.4	40.4
3. Facilitates growth and development of institution	74	25.3	32.5
4. Facilitates innovation	40	13.7	17.5
5. Allows planning and implementation to achieve long-range goals	31	10.6	13.6
6. Local control	30	10.2	13.1
7. Allows balancing (institution, programs, research)	26	9.0	11.4

TABLE 46

EFFECT ON RESEARCH SUPPORT OF CHANGING GENERAL RESEARCH SUPPORT TO PROJECT SUPPORT BY CATEGORY OF RESEARCH PERSONNEL

	Decreased Support Grantee		No Change Grantee		Increased Support Grantee		No Answer Grantee	
	No.	%	No.	%	No.	%	No.	%
177 SCHOOLS								
Instructors	131	74	19	11	0	0	27	15
Assistant Professors	145	82	18	10	3	1	11	7
Non-Faculty Research Scientists	67	38	39	22	6	3	65	37
Associate Professors	78	44	59	33	24	14	16	9
Professors	54	30	71	40	31	18	21	12
116 OTHER RESEARCH INSTITUTIONS								
Faculty	39	34	40	35	2	1	35	30
Professional Research Scientists	77	67	22	19	4	3	13	11
Supporting Staff	81	70	19	17	4	3	12	10
Young Investigators	103	89	7	6	1	1	5	4
Trainees	41	35	35	30	0	0	40	35
Other	17	15	6	5	0	0	13	11

TABLE 47

GRSG GRANTEE RESPONSES TO QUESTIONS, WOULD CHANGE FROM GENERAL RESEARCH SUPPORT TO RESEARCH PROJECT GRANTS DECREASE THE NUMBER OF SMALL PROJECTS, AND IF YES, TO WHAT EXTENT?

Would Small Projects Decrease?

Response	Number of Institutions	Percent of Respondents
Yes	262	89.4
No	16	5.5
No answer	15	5.1
TOTAL	293	100.0

Numbers and Percent of Institutions Answering "Yes" by Percent of Decrease Expected

0-24%		25-49%		50-74%		75-100%	
No.	%	No.	%	No.	%	No.	%
40	15.3	29	11.1	66	25.2	127	48.5

The objectives of the GRS program are continuing ones and, therefore provisions for meeting them must continue. Although the financial climate in which biomedical research is conducted in the 70's is markedly different from that which prevailed when the GRSG program was launched in the early 60's, needs for this type of flexible support, which allows for local decision making, remain at least as acute now as they were earlier for the institutional population served.

A stringent NIH budget for research project grants has elevated the general quality of NIH project grant supported research because of the competition for available support funds on the basis of scientific merit. In the process, some institutions have fared better than others in commanding NIH research project support. Resultant changes in the distribution of research project funds among institutions is reflected in parallel changes in the distribution of general research support funds. Consequently, the quality of GRS activities is enhanced to the extent that GRS is used to reinforce project grant supported research by providing central institutional research resources and by strengthening institutional research capability. The recent reductions in GRS funds also might have elevated the general quality of GRS activities by a selection process like that described above. However, when GRS activities can not be differentiated on the basis of quality, when the level of quality is so high that differences in quality are no longer meaningful, and when differences in quality are so small that they are not significant, continued reductions in general research support have the primary effect

of curtailing the achievement of GRS goals, the importance of which is documented in this issue paper.

The Federal Government depends heavily on non-Government research and educational institutions to pursue its goals of improving both maintenance and restoration of health by creating new knowledge and by providing the physicians and other health personnel necessary to achieve those goals. As long as these Federal demands continue on a large scale and private, and state and local government funds are not available to meet the general research needs of these institutions, the Federal Government will need to provide general research support.

THE FUTURE OF THE GENERAL RESEARCH SUPPORT PROGRAM

This section describes certain alternatives to the general research support programs as they are presently constituted. The alternatives chosen for treatment here are those which seem most likely to be suggested by knowledgeable individuals but differ in complexity, feasibility, and desirability. They are: (1) consolidation of general research support with health professions educational assistance programs, (2) termination of NIH general research support and meeting the need with NSF programs under existing authority or under new authority such as that proposed in the 1969 Miller Bill (H.R. 35), and (3) award of project grants with a portion of each designated for general research support in lieu of a separate GRS mechanism. Any proposal to institute an alternative to the present GRS formula grant mechanisms should be sensitive to findings of the Roth-Boynton study concerning the unique values of funds provided through this mechanism in meeting institutional research needs of the grantees.

Consolidate General Research Support with the Health Professions Educational Assistance (HPEA) Grant Programs

Research is an important and integral part of both health professional education and graduate education in the health related sciences.

Consolidation of GRS (GRSG and BSSG) and HPEA (Institutional and Special Project) programs appears, at first sight, to be feasible because formula grants are common to both programs. Advantages of consolidation would be that the number of grant programs would be reduced and that grantees eligible for both types of support could be given authority to expend funds from a common or combined award for research and for educational purposes in any proportion determined by the grantee.

However, general research support and health professions educational assistance have only superficial similarities. They serve different needs and purposes (Tables 48 through 51). The needs for each type of support vary in magnitude and in proportion to each other from one institution to another. Awards from these programs to health professional schools in FY 1969 are shown in Table 52. Health professions educational assistance is limited to undergraduate education in the health professions, but general research support extends to graduate and postgraduate education and to institutions such as hospitals, other academic institutions, and other research institutions in addition to health professional schools. Changes in the legislative authorization for these programs would have to be sought.

The GRS eligibility thresholds and entitlement procedures constitute a mechanism for maintaining the effectiveness of general research support by adjusting the size of awards to the need and capability of grantee

TABLE 48

ELIGIBILITY FOR NIH INSTITUTIONAL GRANT PROGRAMS

General Research Support Grants	Biomedical Sciences Support Grants	Institutional Grants and Special Project Grants
Health professional schools, nonfederal hospitals, state and municipal health agencies, and nonprofit, nonacademic research organizations.	Institutions of higher education, accredited or approved by nationally recognized accrediting agency, by a state department of education or by a state university. Applications not accepted from subdivisions, including health professional schools.	Public or nonprofit health professional schools accredited by appropriate accrediting body for each school type.

TABLE 49

QUALIFICATIONS FOR NIH INSTITUTIONAL GRANT PROGRAMS

General Research Support Grants	Biomedical Sciences Support Grants	Institutional Grants and Special Project Grants
$100,000 or more of allowable NIH/NIMH Research Project Grants in latest July 1 - June 30 period. The NIH and its advisory groups also consider the degree of diversity, complexity, and breadth of the applicant institution's total biomedical research and research training activities, including support from sources other than NIH and NIMH.	$200,000 or more of allowable NIH/NIMH Research Project Grants in latest July 1 - June 30 period. The NIH and its advisory groups also consider the degree of diversity, complexity, and breadth of the applicant institution's total biomedical research and research training activities, including support from sources other than NIH and NIMH.	Applicants are asked to assure that they will expend non-federal funds during the grant year in an amount at least as great as the average amount of Federal funds expended the three years previously.

TABLE 50

FORMULAS FOR DISTRIBUTION OF NIH INSTITUTIONAL GRANTS

General Research Support Grants (Grant Period of 1/1 to 12/31)	Biomedical Sciences Support Grants (Grant Period of 6/1 to 5/31)	Institutional Grants (Grant Period of 7/1 to 6/30)	Special Project Grants (Grant Period of 7/1 to 6/30 may be increased to 2 years)
Percentage of NIH-NIMH Allowable Research Project Grant Support: 30% of the first $200,000 plus 25% $200,001 to $500,000 plus 20% $500,001 to $1,000,000 plus 10% $1,000,001 to $2,000,000 plus 5% $2,000,001 to $6,000,000 plus 0% $6,000,001 and over Awards are prorated to the amount of funds available.	Percentage of NIH-NIMH Allowable Research Project Grant Support: 15% of the first $200,000 plus 7% $200,001 to $500,000 plus 3% $500,001 to $1,000,000 plus 2% $1,000,001 and over Awards are prorated to the amount of funds available.	Base award $25,000 plus a share of remainder of program total funds, as follows: 75% of remainder distributed according to: (a) an applicant's relative enrollment of full-time students, (b) the relative increase of full-time student enrollment divided by the average enrollment for the preceding 5 completed school years. This calculation provides twice as much for the student increase as for the already enrolled full-time. 25% of remainder distributed on the basis of relative number of graduates in the academic year of the applicant's submission.	Award determined by Secretary. Annual award not to exceed $400,000 except grants awarded: (a) to aid eligible schools in a financial crisis for continued operation, (b) to increase enrollments in schools of medicine and osteopathic medicine.

TABLE 51

GENERAL PURPOSES OF THE NIH INSTITUTIONAL GRANTS

General Research Support Grants and Biomedical Sciences Support Grants	Institutional Grants	Special Project Grants
Support institutions' own health-related research and research training activities. Provide institutions with greater control over the quality, content, emphasis, and direction of their research activities than is possible under the research project grant system alone. Strengthen the institutional base necessary for effective project grant supported research. Enable institutions to forge new directions, innovate programs, and support fledgling ideas and the people willing to tackle them.	Increase enrollment and improve quality of educational programs in health professional schools.	Increase supply of adequately trained personnel in health professions; assist schools in serious financial straits to meet costs of operation or to meet accreditation requirements; to plan, develop, or establish new or modify existing educational programs; improve curriculums; conduct research in fields related to education in the health professions; to develop training for new levels or types of health professions personnel; and to plan or design experimental teaching facilities.

TABLE 52

NIH INSTITUTIONAL AWARDS TO HEALTH PROFESSIONAL SCHOOLS --- FY 1969
(Dollar Amounts in Thousands)

Type of Institution	General Research Support Grants		Institutional Grants		Special Project Grants		Total
Schools of Medicine	$25,419	(99)[1]	$21,123	(100)	$19,783	(60)	$66,325
Schools of Dentistry	2,751	(49)	9,213	(53)	8,722	(26)	20,686
Schools of Osteopathy	132	(5)	1,126	(6)	1,118	(4)	2,376
Schools of Public Health	1,856	(12)	N.A.[2]	-	N.A.	-	1,856[3]
Schools of Pharmacy	684	(12)	N.A.	-	N.A.	-	684
Schools of Veterinary Medicine	1,778	(17)	N.A.	-	N.A.	-	1,778
Schools of Optometry	0	(0)	1,480	(10)	1,685	(8)	3,165
Schools of Podiatry	0	(0)	693	(5)	1,053	(5)	1,746
TOTAL	$32,620	(194)	$33,635	(174)	$32,361	(103)	$98,616

1/ Figure in ( ) gives number of grantees.
2/ N.A. = Not Applicable.
3/ Does not include project grants for graduate training in Public Health under Section 309 of the PHS Act.

institutions to use general research support as measured by NIH-NIMH research project awards. Merger of the programs, except in name only, would make it difficult, if not impossible, either to continue that mechanism for maintaining program effectiveness, or to assure that GRS funds would be provided and expended to undergird the missions of NIMH and the NIH Institutes. A further complication of a simple merger of the programs is that there would be no assurance that funds would be used for the purpose for which they were appropriated, as long as research and education appropriations continue to be made separately. Merger of the institutional grant programs would also eliminate an important institutional incentive for the achievement of excellence by not relating the amounts of formula grants to the level of funding of competitively reviewed NIH-NIMH supported research activities.

Because of significant differences in the purposes, characteristics, and clientele of the two types of support, their consolidation would result in dilution of their purposes and effectiveness.

Abolish the GRSG and BSSG Programs and Depend upon NSF Programs to Meet the Need

Transfer of general support of biomedical research from NIH to NSF would focus institutional support of science in one agency, and could result in a reduction in the number of programs if institutional formula grants from both agencies were consolidated. However, notable differences exist between NIH general research support and NSF institutional

formula grants. There is a lack of congruence in grantee institutions served. NSF awards for general support of science are made only to academic institutions which include many that are not engaged in biomedical research and others that are not presently eligible for NIH general research support. Recipients of NIH institutional formula grants for the general support of biomedical research include not only academic institutions, but also the health professional components of academic institutions (schools of medicine, dentistry, public health, osteopathy, pharmacy and veterinary medicine), hospitals, state and municipal health departments, and other research institutions. In FY 1969, NSF and NIH awarded a total of $70,298,408 for this type of institutional formula grant. Of this total, 20.7 percent was awarded by NSF and 79.3 percent by NIH. The smaller NSF total was distributed among 634 grantees and the NIH awards went to 440 grantees (See Table 53), with 79.1 percent of the NSF grantee institutions receiving awards between $1,000 and $30,000 (See Table 54). These differences would make it difficult to consolidate the programs without diluting their effectiveness for NIH grantee institutions. If the NIH and NSF institutional programs were merged under a common formula with no change either in the total dollars available or in the institutions participating, general support of health research would be reduced precipitously for the benefit of general support of nonhealth science research. Changes in the legislative authorization for these programs would have to be sought.

TABLE 53

INSTITUTIONAL FORMULA GRANTS
FOR RESEARCH, FY 1969

	AWARDS			
	Number	%	Amount	%
National Institutes of Health	440	41	$55,700,000	79.3
National Science Foundation	634	59	14,598,408	20.7
TOTAL	1074	100	$70,298,408	100.0

TABLE 54

NUMBER OF NSF AND NIH INSTITUTIONAL GRANTS AWARDED IN FY 1969 BY SIZE OF AWARD

Size of Grants (in thousands)	Number of Institutions		
	NSF Grantees[1]	NIH Grantees	
		BSSG[2]	GRSG[3]
1 - 2	3	-	-
2 - 3	64	-	-
3 - 4	5	-	-
4 - 5	22	-	-
5 - 6	12	-	-
6 - 7	16	-	-
7 - 8	13	-	-
8 - 9	10	-	-
9 - 10	8	-	-
10 - 20	314	-	2
20 - 30	35	1	28
30 - 50	40	36	46
50 - 100	73	59	80
100 - 150	19	11	49
150 - 200	-	2	36
200 - 250	-	1	21
250 - 300	-	-	29
300 - 350	-	-	12
350 - 400	-	-	9
400 - 450	-	-	18
	634	110	330

1/ The smallest NSF award was $1,000; the largest, $138,967
2/ The smallest BSSG award was $29,510; the largest, $220,000
3/ The smallest GRSG award was $11,900; the largest, $428,705

An important impact of NSF assuming responsibility for all general institutional support for science would be the loss of NIH ability to offer institutional biomedical research support intended to complement and correct imbalances created by NIH project support. Coordination of general research support with project support would become more complicated and less effective if the locus of general research support administration were removed from NIH. NIH could no longer pursue its mission through institutional support of biomedical research, and there would be loss of assurance that university officials would allocate to biomedical research the amounts of general research support needed for that purpose. NSF would need to acquire staff competence in health professional education and certain aspects of medical research if that agency were to have responsibility for achieving the objectives of general research support in health professional schools, schools of public health, hospitals, state and local health departments, and other research institutions. NIH already possesses this competence in a depth and scope that could not currently be matched by the NSF.

If the 1969 Miller Bill (H.R. 35) or the principles embodied in that bill were adopted giving NSF responsibility for administering funds for general science education, such support should not replace NIH administered general support of biomedical research for the reasons cited above.

Award Project Grants With a Portion of Each Designated for General Research Support in Lieu of a Separate GRS Program

If a portion of each research project grant were designated for general research support in lieu of a separate GRS program, consolidation

of programs would be achieved. However, the consequences of such a consolidation militate against it. The consequences include the following.

First, rather than having a centralized fiscal and programmatic operation wherein one branch of an agency has primary responsibility for strengthening institutional environment for research, a series of ten or more offices would operate a series of individual programs of general research support. If a decremental scale of general research support in relation to institutional levels of NIH-NIMH research project support were to be continued, a complex system to coordinate project grant support and fees for self-sponsored research would be required. The decremental feature of GRS formulae is intended to prevent the so-called rich institutions from getting richer.

Second, accountability related to the use of grant funds would be so diffuse that no one Institute could possibly respond in a meaningful manner to inquiries on the question of how grant funds have been used to strengthen any particular institution's research program.

Third, in times of level or reduced funding both the NIH-NIMH investigators and the funding Institutes would not want to place at jeopardy their own aims and missions for general purpose institutional initiatives. The pressure would be to supplement approved and/or funded research project grants because of increased costs of research or of reduced funding. Thus, it would be possible for the grantor Institutes to reduce institutional flexibility in the use of general research support by exerting pressure on the grantees to use general research support for research relevant to the mission of the grantor Institute.

For the reasons cited, inclusion of general research support in each research grant does not compare favorably with the present unified and coordinated general research support program.

Summary of Alternatives

Each of the alternatives described above would achieve the desirable result of reducing the number of programs, but not necessarily simplification of the programs. In fact, administration of the programs would become more complicated for both the Federal Government and the grantee institutions, as long as existing program objectives were continued. Changes in both legislative authority and appropriations structure would be required to effect merger of GRS programs with either Health Professions Education Assistance or National Science Foundation institutional formula grant programs. Since general research support plays a significant role in the pursuit of health objectives, as documented throughout this paper, and since none of the alternatives would achieve the objectives of general research support as effectively as do the present GRS programs, the alternatives described are rejected.

CONCLUSION

The merits of general support of biomedical research and the success of GRS programs have been demonstrated. Alternatives to separate GRS programs would result in either abondonment of the benefits achieved from general research support or dilution of its effectiveness. Continuing evaluation of GRS programs will make it possible to identify ways in which they might be improved or strengthened, and to modify them in response to changing needs when they occur.